ELECTRIC COOKING HEATING CLEANING ETC.

BEING A MANUAL OF
ELECTRICITY
IN THE SERVICE
OF THE HOME

"FANCY COOKING CUTLETS AND FRYING PANCAKES WITH CAPTURED LIGHTNING! IT REALLY SEEMS TREMENDOUS . . . YOU WOULD HAVE FALLEN IN LOVE WITH THE EXQUISITE CLEANLINESS OF THE PROCESS."—*Truth.*

ELECTRIC COOKING HEATING, CLEANING ETC.

BEING

A MANUAL OF ELECTRICITY IN THE SERVICE OF THE HOME

BY

"HOUSEWIFE"
(MAUD LANCASTER)

EDITED BY

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CONTENTS

PAGE

INTRODUCTION 1
IMPORTANT NOTES 5
ELECTRICITY—A BRIEF EXPLANATION FROM A WOMAN'S POINT OF VIEW. 7
- Historical sketch 7
- Dr. William Gilbert's discoveries 8
- Dr. Benjamin Franklin's Researches 8
- Electricity a silent and valuable help 8
- How Electricity gives light 9
- How Electricity gives heat in Cooking 9
- How Electricity is used in Heating 10
- Electricity as applied to Ventilation 10
- Cleaning by Electricity 11
- Electricity for bedroom use 11
- Electricity for sundry domestic purposes 11

WRONG IMPRESSIONS OF ELECTRICITY 12
- Electricity as a means of cooking food 12
- Converting Electricity into Light, Heat and Power 13

COST OF ELECTRICITY 18
- One penny or two cents' worth of electricity: what it will do. . . . 17

WHAT ELECTRICITY CAN DO IN THE HOME 19
TIME NOW RIPE FOR THE USE OF ELECTRICITY FOR ALL DOMESTIC PURPOSES 22
COMMERCIAL ASPECT OF ELECTRIC COOKING. DUTY OF CENTRAL STATION ENGINEERS 23
WHY ELECTRIC COOKING IS IDEAL AND BEST 29
- Table control of light cookery 29
- Ease of operation 30
- Concentrated and constant heat 30
- Comparison with gas cooker 30
- Cool kitchen 31
- Clean kitchen 31
- Saving of labour 31
- Saving in cost 31

PAGE
Increased value 31
Other cookery objects improved 31
SCIENTIFIC OPINIONS ON CORRECT METHOD OF COOKING 33
A SHORT HISTORICAL SKETCH OF PROGRESS AND EXPERIMENTS IN COOKERY 34
Cooking by Heat storage analagous to electric cookery 34
MODERN COOKERY 40
WHY WE COOK 42
A brief outline of the chemistry of cooking 42
Roasting or baking 43
Boiling 43
Stewing 44
Frying 44
Frittering 44
Vegetables 45
Food a non-conductor of heat 45
SHORT ACCOUNT OF ELECTRIC HEATING AND COOKING FROM 1890 TO 1914 46
Progress during past few years 56
ELECTRIC COOKING 57
The ideal to be aimed at 57
HINTS ON ELECTRIC COOKING 61
Electric cookery chart, roasting and baking 60
Electric cookery chart, boiling and stewing 62
Electric cooking of meats, time taken 64
Meat losses 65
Diagrams of comparative losses 66
COMPARATIVE LOSSES OF MEATS COOKED WITH COAL, GAS AND ELECTRICITY 67
TYPES OF HEATING ELEMENTS 69
ELECTRIC COOKING IN SCHOOLS 76
School kitchen 76
ELECTRIC COOKERY AT THE TABLE 82
Examples of small portable apparatus 82
B. T-H. Radiant grill 84
Heetorboil food warmer 85
Just-for-two table cooker 85
Combination breakfast set 86
Pygmy Heater 87
Toasters 87
Coffee percolators 89
Tea samovar 90
The electric chafing dish 90
Kettles and self-contained portable water heaters 91
Water jugs and milk boilers 95
Milk sterilisers 96

PAGE

ELECTRIC OVENS AND KITCHEN COOKERS.......................... 97
Hot plates and Boiling discs.......................... 98
PLEXSIM COMBINATION OUTFIT.......................... 100
Venner silver grill.......................... 101
Plexsim oven.......................... 103
Credenda oven.......................... 104
General Electric Company's Magnet Cooker.......................... 106
Berkeley Automatic cooker.......................... 106
Dowsing's cooker and grill.......................... 108
Lightning oven.......................... 108
No-Kaire cooker.......................... 110
Kelvin oven and hot plate.......................... 111
Electroyl portable oven.......................... 112
Bastian oven.......................... 113
Hot-point oven.......................... 115
Gilbert cooker.......................... 116
Franklin cooker.......................... 117
Newton cooker.......................... 117
Tricity Cooker.......................... 118
Ferranti ovens and cookers.......................... 120
Belling Cookers.......................... 124
Falkirk Domestic Cooker.......................... 126
Electrical Company's New Cooker.......................... 128
OVEN EFFICIENCIES.......................... 131
Oven heat curves.......................... 132
ELECTRIC COOKERS.......................... 136
General Electric cooker.......................... 136
Copeman cooker.......................... 138
British Prometheus Cooker.......................... 139
Hughes cooker.......................... 141
Simplex cooker.......................... 142
British General Electric Cooker.......................... 143
Nightingall Oven.......................... 144
Large Plexsim Cooker.......................... 145
Carron cookers.......................... 146
Eclipse cookers.......................... 149
Jackson cookers.......................... 150
Electroyl Cookers.......................... 153
EXAMPLES OF WEEKLY COOKING OPERATIONS IN A SMALL FAMILY WITH ELECTRIC COOKER, AND COSTS.......................... 156
EXAMPLES OF LARGE COOKING PLANT FOR HOTELS, ETC.......................... 162
Falkirk Grill.......................... 162
Large Electroyl Toaster and Grill.......................... 163
Vegetable steamer.......................... 165
Fish and Potato fryer.......................... 165

PAGE

Benham Electric Bread Baking Oven 167
Benham Bread and Pastry Baking Oven 168
Electric Baker's oven and all electric bakery 168
Benham Electric hot closet and serving table 170
EXAMPLES OF LARGE ELECTRIC KITCHENS 173
B. & K. Restaurant 173
Debenham & Freebody 178
Torquay Pavilion 179
Polytechnic Restaurant 182
Tricity House 183
Middlesex Guildhall 185
Stanley Hotel, "An All-electric" Hotel 188
Old Ship Hotel 190
Empire Hospital, Westminster 193
Pier Restaurant, Cape Town 195
Romano's Restaurant 196
Electric Cooking at the Bank of England 199
ELECTRIC HEATING OF WATER 201
Efficiency 202
Useful tables 204
Belenus water heater 205
Losles " " 208
Cooper " " 206
Therol " " 210
Ferranti " " 213
Ellsee " " 214
Bankside " " 215
Fuller geyser water heater 216
Jackson rapid " " 218
Simplex " " " 219
ELECTRIC HEATING 220
Amount of heat required for warming a room 223
Luminous radiators 224
Convectors 232
Radio-convectors 235
Bed warming 242
Foot warmers 245
VENTILATION AND AIR PURIFICATION 246
Ventilation 246
Air purifiers 248
Vohr Ozone generator 249
Ozonair generator 249
ELECTRICITY FOR MEDICAL PURPOSES 252
Radiant Heat baths 253
Electric vibrators 255

PAGE

Sundries 256
Hair drying by electricity 256
Hair curlers 256
Electric Cleaning 258
Sweeping and Dusting 258
Permanent installations 259
Semi-Portable Cleaners 260
British Electric Vacuum cleaner 260
Wizard Electric Suction cleaner 261
Santo " " " 262
Bissell " " " 262
Portable Cleaners 263
Frantz electric cleaner 263
Magic " " 264
Diamond " " 264
Some Domestic Electric Accessories 265
Your sewing machine driven electrically 265
Simplex sewing machine 266
Singer sewing machine 266
Bissell " " 267
Electricity in the scullery and wash-house 268
Maytag clothes washer 268
Federal " " 270
Apex " " 271
Ironing by electricity 271
Coffee grinding and food chopping 278
Coffee roasting 278
Plate and dish washing 280
Maid-of-all-work 282
Boot-cleaning 283
Knife Cleaning 283
Polishing Silver Goods 284
Potato peelers 285
Ice-making and refrigeration 287
Electric Glue Pots and Sealing-wax heaters 287
Soldering irons 289
Some Special Heat Applications of Electricity for Industrial Uses 290
Three Years' Experience in Cooking and Heating in an All-Eletric Home with Examples of Monthly Cooking Costs. 291
Other Examples of Electric Homes 299
Some Technical Terms Simply Explained 301
Ampere 301
Broiler 301
Circuit (parallel, series, D.C. and A.C.) 301

PAGE
Cut-out ... 303
Earthing ... 304
Electric motive force ... 304
Electrical energy ... 304
Element ... 304
Flexible ... 304
Fuse or cut-out ... 305
Grill or broiler ... 306
Heating element ... 306
Hot cupboard ... 306
Hot plate ... 307
Kelvin ... 307
Kilowatt ... 307
Kilowatt-hour ... 307
Pilot lamp ... 307
Resistance ... 308
Short circuit ... 309
Switch ... 309
Unit or Kelvin ... 310
Volts ... 310
Watt ... 311
Watt-hours ... 311
Wall-socket ... 312
PRICES CHARGED IN GREAT BRITAIN AND THE UNITED STATES OF AMERICA FOR ELECTRICITY FOR HEATING, COOKING AND POWER 313

INTRODUCTION

The following pages are feeble efforts of mine to help my "sisters in distress," and to convince them of the wonderful blessings provided for us by nature's gift of Electricity which, aided by scientific research and inventions, is capable of doing so much towards bettering the home life.

Electric cooking and heating are by no means new, early attempts having been made so long ago as 1890, but partly on account of imperfect apparatus, but more by reason of the high prices which, until recently, were asked for electrical energy used for such purposes, their development and adoption have been slow.

Now, however, that apparatus has been perfected and specially favourable rates are available in most districts, there is nothing to hinder the widespread adoption of electricity, not only for cooking and heating, but for many purposes in the home at present carried out more or less successfully by hand. Once the simplicity, efficiency and perfection of electrical operation are realised, I am absolutely convinced that it will be adopted in every "real" home.

Having been housekeeping for many, many years (too many to announce), I have unfortunately bought my experience and

paid for it dearly, but "as all things come to those that wait" I now revel in the bliss of an Electric Kitchen and electricity throughout the house generally. My home life, therefore, is much more easy, agreeable and healthful, both for my family, and my maids, and as servants or helps are like ourselves, "human beings," and good servants or helps are few, it is of the utmost importance to do all we can to make things healthful and easy for them, if we wish to ensure a placid and serene existence in our homes.

The advantage of Electric Lighting is now fully established and beyond question, but when its possibilities are more fully understood and applied, Electricity will be used for purposes unthought or undreamt of at present. Its use in *cooking, heating, ventilating, air purification* and *cleaning* marks the commencement of the electrical age, and I am convinced that it will soon become established in general use for these and many other purposes, and be looked upon as one of the greatest blessings in daily life in providing the home with *economic labour- and dirt-saving service*—making existence for every wife and every maid or help more comfortable, more enjoyable and more healthful.

The hard-working husband also will find that things have changed for the better—for instead of finding on his return home, a "neurotic" wife, worn out with the worries of housekeeping and domestic troubles, he will be welcomed by a loving woman, bubbling over with mirth and joy, a sure antidote for all the worries and trials which each man, more or less, has daily to encounter in this strenuous and competitive age.

Then, too, our little ones will be the happier, for we are apt to be so irritable, even with them, if our domestic arrangements are all upside down!

I do so wish to impress upon my readers *the vast importance* of our food *being properly cooked.* Good health is such a big "factor" in the happiness of

life, and it is wrong of us to neglect it! Digestion is impaired and ruined by overlooking this important fact, and I am convinced that if we, as "housewives" (for, in spite of "advanced ideas," true housewives *do still exist*) will only devote a little time to the preparation of food for the sake of our own health and that of those around us, we shall save many of those dear ones from being semi-invalids, and aid in securing a race of more healthy and robust people.

In order to convince my readers that "Electric Cooking" is the "*ideal method*" and is likely to revolutionize all other systems, I have searched through various records of Ancient and Modern Cookery, and I cannot better substantiate my views than to quote from some of the reliable and scientific sources that have given me the data upon which I have worked with such great success! Generally there is no doubt that proper Cooking is *slow* cooking, and carried out electrically is absolutely *less costly* than by other means, *apart* from the great saving of labour, the absence of dirt, and the better sanitary and hygienic conditions which accompany electrical operation!

Some of my readers may say, What have these historical facts, and the Chemistry of Cookery, to do with *Electric Cooking?* To these I say "Everything." These facts prove that it has been known for thousands of years that moderate, uniform and constant heat are the chief requirements in cooking. Those whom I shall name later on have been vainly trying to teach these principles, and others have been vainly trying to obtain from apparatus heated with coal, gas and other combustible materials, *a constant cooking temperature.* Owing to many causes, such as attention to fire, varying draughts, constant watching and turning of the article to be cooked, it has been impossible in an ordinary household to obtain the conditions necessary for this proper and hygienic form of cooking.

In this volume I deal chiefly with the application of such electrically operated appliances for use in the ordinary household as come chiefly under the sphere of woman's work.

Throughout all my interviews and demonstrations, which have been most instructive and helpful, I have kept absolutely to facts and statistics. May this little work, which is but a sketch of a most interesting and important subject, accomplish the end I have in view! Then I shall have the joy of knowing my efforts have not been in vain.

M. LANCASTER.

17 HEENE TERRACE,
WORTHING,
AND ELIOT BANK, LONDON, S. E
ENGLAND.

Electricity a Silent and Valuable Help.

IMPORTANT NOTES

I HAVE endeavoured throughout this book to avoid the use of many technical terms. A simple explanation of those that are in general use in connection with Electric work will be found on pages (301–312).

In dealing with the cost of Electricity, I have in all cases based my calculations upon Electricity supplied for Heat and Power at 1d per unit in Great Britain, and 2 cents per unit in America, so that readjustment to prices in any district can readily be made.

The cost of working the various appliances and comparisons are based on these figures throughout.

I am indebted to the Electrical Press and my many Electrical Engineering friends for their great kindness, courtesy and help; to the Manufacturers in the supplying of useful information and blocks for illustrations, and their generous support, which has enabled the book to be published at a popular price. I am especially indebted to the British Westinghouse Company for their midget blocks, The Simplex Conduits, Ltd. for their excellent line blocks and the General Electric Company of America for many beautiful half-tone illustrations, also to Dr. Robert Hutchison, F.R.C.P., for his very kind permission to use extracts from his valuable works. I have drawn largely on his book, "Food and the Principles of Dietetics," [1] and the work of Count Rumford, also on W. Matthieu Williams' excellent book, "Chemistry of Cookery" which I have been pleased to see on many of the noted "chef's" bookshelves.

[1] "Food and the Principles of Dietetics," by Robert Hutchison, M.D., Edin. F.R.C.P. Published by Edward Arnold, 4, Maddox Street, London, W.

Electricity—the Good Fairy.

ELECTRICITY

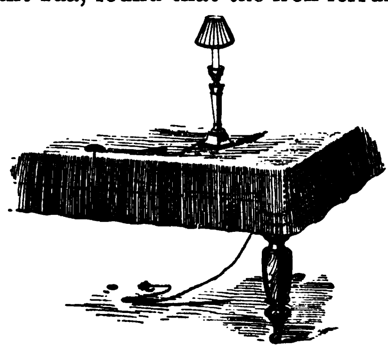
A BRIEF EXPLANATION OF ELECTRICITY FROM A WOMAN'S POINT OF VIEW

It is impossible for me to tell *what Electricity is!* I cannot even learn myself from our *greatest Scientists* "*what Electricity really is.*" They know how to collect it, or "generate" it, also many methods of utilizing it for the benefit of mankind.

Historical Sketch. In tracing its history, the first record is the attraction of Amber for light objects, which was named by the Greeks "Electron." Beads of Amber are known to have been used more than 2000 B.C.

Pliny says, "The Syrian women called the *Amber* spindle which they used for spinning '*the clutcher*' because it attracted or drew the thread and light pieces to it, when it rubbed against any soft material such as the garments of the person handling it."

The next record is the "loadstone," or magnet, named after *Magnes*, who, as stated by the poet Nicander, in his writings about 800 B.C. (and also recorded by Pliny), when taking his flock over the slopes of Mount Ida, found that the iron ferrule of his staff and the nails from his shoes adhered to the stone.



It is further recorded that the magnet was used in many ways to deceive people. Very few were acquainted with its mysterious force, which was looked upon as some supernatural power. Many centuries elapsed before any further reliable record was

made. The mariner's compass was known during the 11th century, and was no doubt of North Sea origin, and taken across land to China by missionaries about the 12th century. The North and South attractive forces were discovered by Peregrines in the 13th century, but it was not until the 16th century that Dr. William Gilbert first discovered and demonstrated their utility and made known that the earth was one great magnet. William Gilbert was really the father of science; he demonstrated the Electric charge and discharge and gave the words "Electrica" and "Electricity." Isaac Newton subjected Gilbert's discoveries and theories to law, and conceived the idea that Electricity, Magnetism, and Gravity might be the manifestations of the great controlling power.

Dr. Benjamin Franklin's Researches. The next record of importance was the discovery by Dr. Benjamin Franklin of the fact that the lightning discharge from the clouds, and the Electric discharge from Amber or an electric machine, were one and the same. Faraday and other great scientists added to the knowledge by much research work.

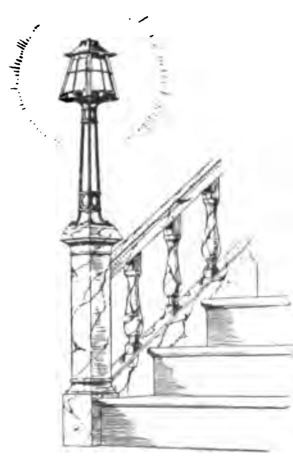
The commercial or practical use of Electricity was, however, unknown until the 19th century, when the Electric Telegraph was introduced, followed by the telephone, and later by the Electric Light, all the commercial development being within living memory—nearly all within the last 50 years.

Electricity a Silent and Valuable Help. Electricity, like the force of gravitation, makes a most *valuable servant*, when put to do *useful work*. In its capacity as a servant, it is always at hand; *always willing* to do its allotted task and to do it perfectly, *silently*, swiftly and without mess; never wants a day off; never answers back; is never laid up; never asks for a rise; in fact, it is often willing to work for less money; never gives notice and does not mind working overtime; it has no prejudices and is prepared to undertake any duties for which

it is adapted; it costs nothing when not actually doing useful work. Such are the merits of the housewife's new ally, a worthy substitute for carrying out many of the duties now done more or less willingly and well by the independent human servant or help of to-day.

In House Lighting for instance: On entering the hall or a room we turn on a switch and immediately a flood of light is emitted from a little glass bulb suspended from the ceiling, or fixed in a bracket or Electrolier! But *how* is this caused?

How Electricity Gives Light. It is simply caused by a circuit being completed between the wires in the house conducting the electricity, and those in the road conveying the energy from the Supply Station, where Electricity is generated or produced. The Electric energy is conducted by insulated copper wires (carried in steel tubes or wooden casing) through the controlling switches to the *lamp*. The latter consists of a glass bulb containing a length of very thin carbon or rare metal called a "*filament*"; this "*filament*" offers a great deal of resistance to the passage of Electricity; and allows but a small *quantity* (or what is technically called a small *current*) of Electricity to pass through, and this, in being forced through such resistance by the pressure (or what is technically called the *voltage*) at which the current is supplied, makes the filament *white hot* or incandescent and thus gives Light. As the glass bulb is void of air, no combustion can take place, nor is the heat conducted to the glass except in a very, *very* small degree. We are thus able to get a large amount of light *without* an appreciable amount of heat.



How Electricity Gives Heat in Cooking. In the apparatus for Cooking, the *filament* of the lamp is replaced by a larger and longer wire, called an "*Element*." The *Element* is made to give off *heat without light* and to transfer its heat (or as

much as is possible according to the apparatus used and its efficiency) to the purposes required. For Baking, the heat *Element* or *Elements* are enclosed in a chamber and the heat directed to the object to be baked. For Boiling, the *Elements* are enclosed under the plate arranged to receive the kettle, saucepan or other utensil containing the material to be "*boiled*" or "cooked." For any "self-contained" apparatus, the heat "*Element*" is enclosed in part of the apparatus and acts around or upon the bottom part of the substance to be heated. The conducting wires (in tubes or casings) are similar to those used for *Lighting*, but as more Electricity is required, they are, of course, larger. This also applies to the switches, etc.

How Electricity is Used for Heating. Similar insulated wires, switches, wall plugs, etc., to those used for Electric lighting and Electric cooking are installed; the switches to operate the Heater or Heaters may be fitted on the wall or on the heating appliance.

The heating appliances may have elements in the form of *large* Electric lamps fitted into ornamental cases; or *Elements* similar to those used in some of the Cooking apparatus, but enclosed in a case to warm or heat the air, partly by convection and radiation, and slightly by conduction.

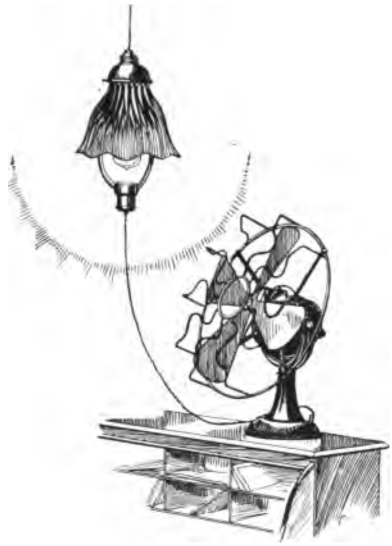
The glass bulb heaters were the first practical form of Electric heating and were invented and introduced in 1890 by Mr. H. J. Dowsing, and supplied by the Dowsing Radiant Heat Company.

Electricity as Applied to Ventilation. Ventilation is effected by drawing in fresh air and removing the impure air. Small electrically-driven fans are used to give frequent change of air.

The speed is controlled by a regulating switch, and connection to the source of supply is effected through flexible wire and an adapter or wall-plug in a similar manner to the other apparatus already mentioned. Electric ozone generators are now provided to purify the air and supply an additional

amount of oxygen where required. Every extra atom of oxygen set free attacks organic impurities and burns it up, leaving the air clean, sweet and invigorating.

Cleaning by Electricity. For cleaning rooms it is simple to connect an Electric Vacuum cleaner to the wall socket provided for the Heaters. Simply by passing the nozzle over the part to be cleaned the dirt is immediately drawn into a bag or chamber to be carried to the dust-bins, without a particle escaping into the room.



An Electric Table Fan.
Simplex Conduits, London.

Electricity for Bedroom Use. The greatest comfort can be obtained by the use of electric Heaters in various forms; the Electric bed-warmer in place of the hot water bottle; a connection made with the wall plug to give hot water, heat an iron, dry the hair, give a warm pillow and to do many other useful things.

Electricity for Sundry Domestic Purposes. Then we have, connected in a similar manner as the other apparatus, *Carpet Heaters*, which consist of a new form of *Heat Element* interwoven in a Heat-resisting and insulating material (such as asbestos) in the form of a mat or blanket. This can be put under any carpet or rug and imparts a pleasant warmth to the feet and to the surrounding air.

There are also Electric *Cushions*, Electric *Pillows*, Heating bandages, Electric *Hot Pads*, Electric *Towels*, Electric *Hair Driers*, Electric *Hair Curlers*, and many other portable appliances which are put into operation by inserting a connecting cap or plug into a lamp or wall socket, the same as one would fit a lamp or push in a key, all of which come under the heading of *Electric Heaters*.

WRONG IMPRESSIONS OF ELECTRICITY

I would like to remove some very, very wrong impressions of electricity that many have, and propose to do so as briefly as possible, but it is important to have a clear understanding of the principles involved before proceeding.

Electricity as a Means of Cooking Food. First of all let me point out—In cooking, the Electricity or Electrical Energy *does not pass through the object to be cooked,* as many have erroneously supposed, nor is the object acted upon by the flow of Electricity between two points, such as lightning flashes or between carbons, as an Electric *arc.* This form is only used where *very* intense heat is required for fusing or melting metals. In the case of a gas stove, the hot gases do the cooking, but with Electric cooking, the Electrical Energy is simply used in the " Element " (resistance) arranged for the purpose of supplying heat.

One often hears people say " they thought electricity or electric light *had no heat, and how therefore can you cook by it?* " The answer to this is that electric light, in the sense usually understood by the term, is not used for electric cooking and heating. It is not correct, of course, to say that electric light has no heat. There cannot be light without heat, at least when produced artificially, and there is a small amount of intense heat with electric

light. An incandescent electric lamp has a filament burning at a white heat, but the glass bulb remains cool because there is no air inside to conduct the heat away from the glowing wire. The only heat experienced *outside* the bulb is that produced by radiation, and by conduction through the wires which pass through the lamp cap to the filament inside. In electric cooking and heating apparatus, it is electrical energy that is used, not as light, which is only one of its many manifestations, but as an agent which heats specially designed materials through which a current is caused to flow.

Converting Electricity into Light, Heat and Power. Electrical energy may be employed to ring a bell; to operate telephone or telegraph instruments; to deposit silver or other metals on plate or cutlery; to light up lamps; to ignite the charge of gas in a motor car engine; to propel electric tramcars or railway trains; to drive all sorts of machinery, or to cook joints or boil water. The same source of supply can be used for any or all these applications; it is merely a question of employing suitable appliances for converting the electrical energy into the desired form. Light, heat, and power can be secured at will wherever the supply mains are laid, and if electric light is already installed in the house, it is quite a simple matter to make use of the existing wires, or to put in additional circuits, for cooking, heating, cleaning, and many other domestic purposes.

It is true that in the case of electric luminous radiators, long lamps with glowing filaments are used to produce the heating effect, and that these lamps give out a certain amount of light. The filaments in these lamps are of carbon and are both long and thick, being designed to absorb a large quantity of electrical energy. Their heating effect is due to radiant emanations from the glowing filaments, which pass through the bulb, heating any


Radiant Lamp.

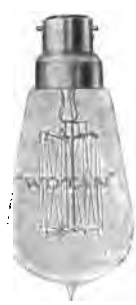
solid object such as a person, furniture, or carpet receiving the rays, which, however, do not directly heat the air. A certain proportion of the energy given off by the filaments is available in the form of convected and conducted heat, convection being the process of warming the air through contact with a heated surface such as the glass bulb and metal case of the radiator, and conduction being the transference of heat through solid objects which are in direct contact with the heating surface. If a lamp with a carbon filament used for lighting were so made that it used as much current as a radiator lamp, its heating effect would be equally as great, and the proportions of radiant, convected and conducted heat given off, would vary according to the temperature at which the filament was running. A lamp with a metal filament gives out little heat, not because its filament is cooler than one made of carbon, for its heat is more intense, but such a lamp is designed to give out a maximum of light for a very low current consumption, and because it uses but little current, its heating effect is small. A carbon filament for physical reasons cannot be run at a very high temperature for long periods, consequently its efficiency is low from an electrical point of view, but a metal filament formed of the refractory material known as tungsten, can safely operate at a high degree of incandescence and its electrical efficiency is increased proportionately. Hence the saving in electricity bills effected when the old carbon filament lamps are replaced by those having tungsten filaments. Such filaments would be unsuitable for use in heating lamps because it is heat and not light that is required, and the carbon filament gives out a far greater proportion of the energy it absorbs as heat than light. Radiator lamps usually take 250 watts or $\frac{1}{4}$ unit per hour each, but if a tungsten lamp were so constructed that it took the same amount of power, its heating effect would be identical, except that a still higher proportion of its energy would be given out as radiant heat, with a


Carbon Lamp.

corresponding decrease in convected and conducted heat. A luminous radiator gives out its heat the moment the switch is turned on, and the electrical energy waves through it, because the radiant energy is thrown off as soon as the filament commences to glow, and as these rays travel through the air with the speed of light, without warming it, they reach and warm any solid objects in their path instantly. For this reason, the lamp radiator is the most popular style of electric heater for its effect is immediate and users experience a warm glow the moment they stand in the path of its rays.

Tantalum Lamp.

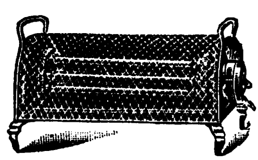
Convectors or non-luminous heaters, on the other hand, operate on a different system. In place of a lamp containing a glowing filament surrounded by a vacuum, there is a resistance strip or coil called an " Element " through which current is allowed to pass. This resistance unit is exposed to the air, and quickly becomes heated, since it is formed of a substance which is not a good conductor of electricity, and exhibits its reluctance to permit of the passage or current by becoming hot. This effect is employed to heat the surrounding air by convection and the case of the heater by conduction. A circulation of air takes place, the heater being so arranged that cold air enters at the bottom, becomes heated by its passage around the "element" and leaves at the top, thus raising the temperature of the room. Since the only heating effect is obtained by warming the air, users obtain no benefit from such a heater until the air between them and the convector has been heated, and this involves delay, although heating begins as soon as the switch is turned on. Such heaters are not suitable where instantaneous warmth is required, but are the best form for warming rooms used for many hours at a time, since the temperature of the whole apartment soon reaches a comfortable degree, sooner in fact than would be the case where lamp heaters are used.

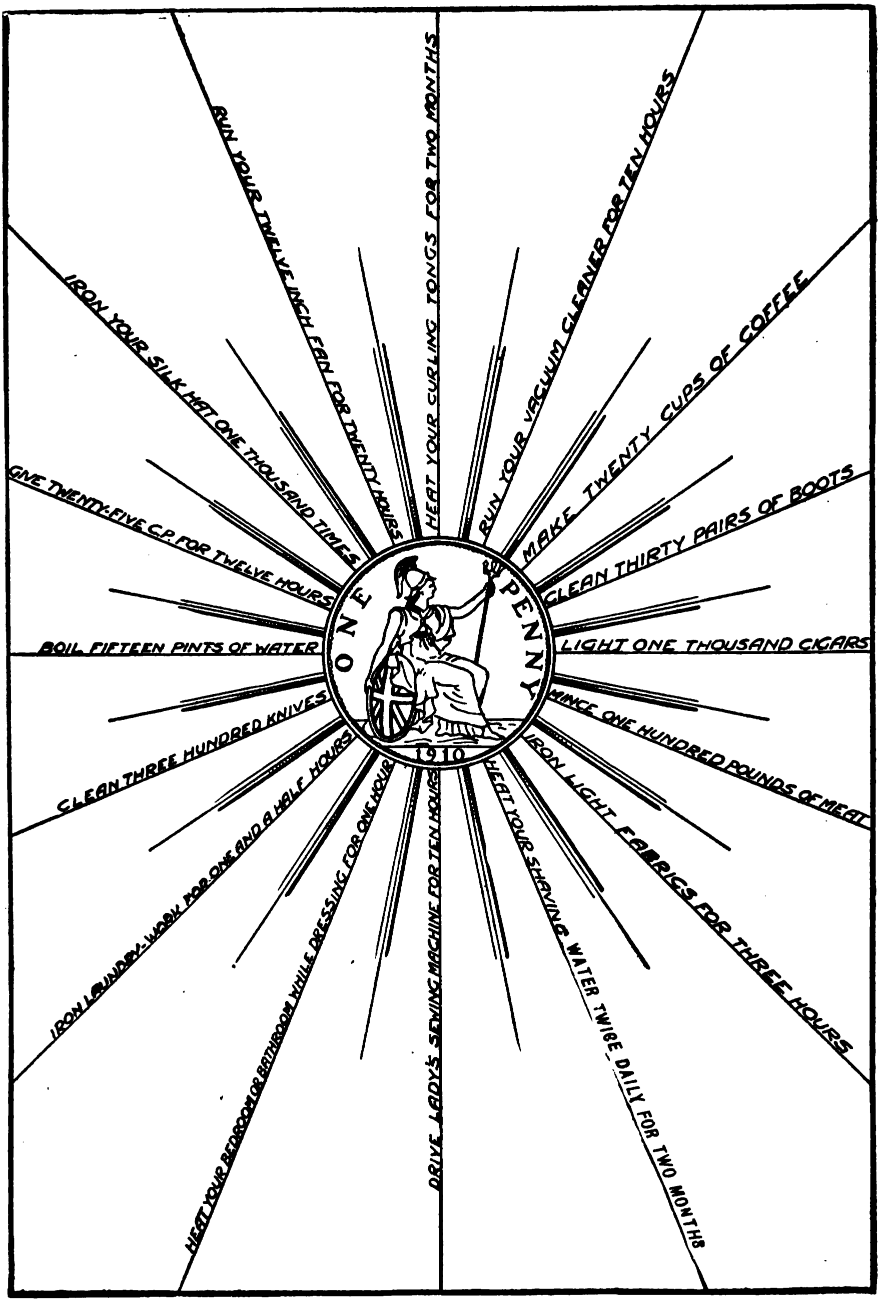

Tungsten Lamp.

A third system of electric heater combines the advantages of the luminous and convector patterns,

and is becoming increasingly popular. The elements used in this class of heater, run at a red heat, give out not only convection currents, but a large proportion of radiant heat. They are more cheerful in appearance than the convector, and not so glaring as the lamp radiator; in fact they more closely resemble a glowing red fire, with a similar heating effect. A compromise between the luminous radiator and convector can be had in the form of apparatus which comprises both heating lamps and non-luminous elements, either or both being available as required. The elements used in electric cookers resemble those used in radio-convectors, and run at a red heat, but their heating effect is restricted, of course, to the oven or hot-plate to which they are attached, although if the oven door were opened or no vessel placed over the hot-plate, they would act as convectors and raise the temperature of the surrounding air.

Certain cooking operations, such as grilling, toasting, pastry work, and so forth, require radiant heat in larger proportion than convected heat, and an adequate percentage of this class of energy is not secured until the heating surface reaches a visible red. Low temperature cooking, i.e., stewing, water boiling, roasting, and so on, may be carried out satisfactorily with elements working at far below a red heat. The same elements may be used for all purposes, provided they are so arranged by special switch control, that more or less current will pass through them as may be desired. Their temperature may thus be varied through a wide range, the control being analogous to that of a gas flame, except that in the case of electricity, the temperatures obtained are definite for each switch position and that they are always identical in any given conditions and are unaffected by draughts, by a neighbour's use of her cooker, or by variations in the pressure—three serious and common troubles with gas flames.



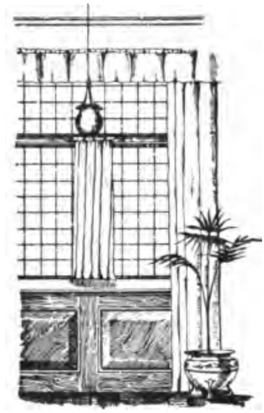


One Penny or Two Cents' Worth of Electricity—What it Will Do.

COST OF ELECTRICITY

The price charged for current when used for lighting varies from 3d. or 6 cents to 6d. or 12 cents per unit, but when cooking or heating apparatus is employed, a specially low rate can be obtained in most districts, upwards of seventeen places in England offering current for these purposes at ½d. per unit, and in America some districts charge as low as 1½ cents. In time this rate will be the one most generally in force; at present many undertakings are asking 1d. and 1½d. per unit except in special places where fuel is comparatively free of cost. At 1d. in England and 2 to 4 cents in America electricity is most favorable from every point of view, but at ½d. a unit in England and 2 cents per unit in America it pays any householder to "live the electric life" and to forswear coal and gas altogether. It is important to remember that the "same kind of electricity" is used alike for lighting and for cooking, although different prices may be charged for the two services. The reason for a distinction in price is based on economic considerations too complicated for discussion here, the general idea being that as current for heating and cooking is needed as a rule when the demand for artificial light is least, it pays the supply undertaking to offer energy at such times at low rates, in order to encourage its use at hours when little would otherwise be demanded.

It may be asked whether in these circumstances a user is compelled to restrict his cooking and heating operations to those hours when no lights are running, but as a general rule this is not made a condition. In some districts the time and day when apparatus is used affect the basis upon which the charge for current is made, but the modern tendency is to simplify the question of charges and to impose as few restrictions as possible upon the free use of current. The tariff question is treated in a later chapter and may prove of interest to those who require further information on the point.



WHAT ELECTRICITY CAN DO IN THE HOME

Having briefly stated the several principles involved let us see what Electricity can do.

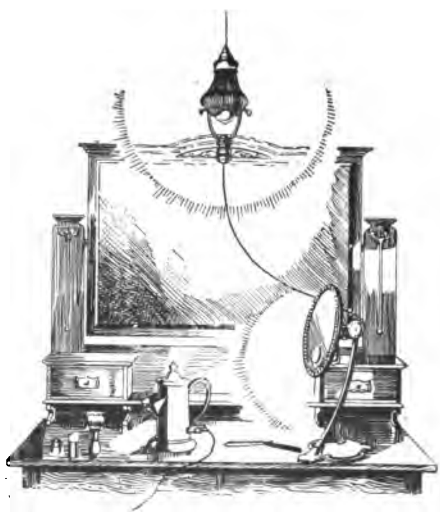
Light the home without fumes, dirt or vitiating the air we breathe, because it gives light without the consumption of oxygen from the air.

Light up pictures, fountains, shaving mirrors and many other useful artistic, decorative and healthful methods of application where only Electric light can be adopted.

Light cigars and cigarettes.

Warm the fresh air as it enters the house and so keep the rooms warmed, causing a continuous change of air without consumption of oxygen and giving perfect ventilation.

By means of fans keep the house cool in summer; produce ozone for giving a larger supply of oxygen to any room; dry and air the clothes.



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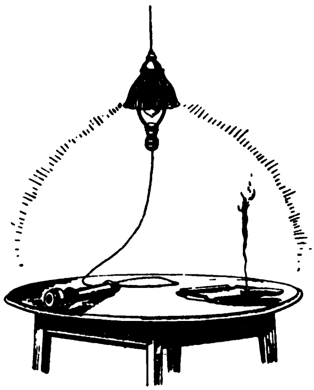


Dry the hair, air and warm beds, etc.

Operate a vibro-massage machine.

Heat any substance or material.

Heat irons for silks, blouses and laundry work.

Heat curling tongs and goffering irons.

Polish and iron silk hats.

Heat water for cleaning purposes.

Sterilise liquids.

Boil water for drinking purposes.

Cook all the food and keep it hot.

Toast bread, cook eggs and other dainty dishes at the table.

Roast and grind the coffee and prepare a delicious beverage from it.

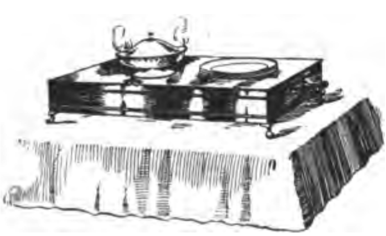
Chop and mince meats and other substances required for cooking. Make ices.

Peel potatoes, apples and similar objects. Clean all the rooms.

Draw all the dirt and dust from *carpets, blinds, curtains, papers, floors, walls, windows, bedsteads, mattresses, beds, draperies and other furnishings* of the home by means of Electric suction cleaners without driving particles of the dirt and dust into the air to be taken into the mouth, nose, throat and lungs or depositing the dust elsewhere, as ordinary sweeping does.

Clean the knives with ease and simplicity by means of small motor.

Clean the boots and shoes.



Wash and mangle clothes.

Wash up plates and dishes.

Work motor for plate and silver polishing.

Work sewing machines for all sewing.

Work lathe and saw.

Work player-piano.

Drive all the clocks throughout the house and operate alarums for waking servants, etc.

Open doors and gates from a distance.

Operate a fountain.

Pump water.

Give light or Radiant Heat baths and do MANY *other useful things* for the personal comfort in the home.

Flowers and plants are maintained in a healthy and proper condition in the house where Electricity is used for domestic purposes.

Corner of Washouse, with, "Simplex" Domestic Washer.

TIME NOW RIPE FOR THE USE OF ELECTRICITY FOR ALL DOMESTIC PURPOSES

Now that the charge for Electricity for cooking and heating has in many cases been reduced to reasonable prices and the manufacturers have brought many of the Electrical devices to a stage at which they are both reliable and efficient, the comparison between Electricity and coal or gas, when properly used, is largely in favour of electricity. Those who were the first to use it for such purposes have had so many months' or years' advantage over others, in the enjoyment of healthier surroundings—at a cost in many cases less than they had previously paid for a much inferior service.

Appliances for cooking are available for households of any size. There are both small and large ovens, with or without hot plates, for boiling or broiling and grilling. Separate heaters can be added at any time without great cost, if further facilities for cooking are needed. Ovens and hot plates may be fixtures or in portable form for use in the kitchen or any other room where there is an electric supply for cooking or heating or other domestic purposes, ready for use at any time without trouble and without fumes. dirt or other objectionable features.

THE COMMERCIAL ASPECT OF ELECTRICAL COOKING THE DUTY OF CENTRAL STATION ENGINEERS.

In many parts of Great Britain and America, as well as in Canada and the British Overseas Dominions, central station Engineers have realised that in electric cooking and heating they have a means of increasing very materially their outputs during the daytime, and that such additional load will form an attractive source of revenue, since it will be secured without any proportionate increase in the standing charges or running costs. Experience already shows that while the demand for units for cooking and heating purposes improves the load factor, it does not necessitate the provision of generating plant sufficient to supply the whole of the connected load. It has been found that the provision of plant of a capacity equal to 20 per cent of the kilowatts connected provides, in the case of cooking and heating apparatus, a sufficient margin, the diversity factor being such that in practice the maximum load demanded never exceeds this proportion of the total wattage connected to the mains. For the same reason, existing mains will usually be large enough to carry the additional load due to the cooking demand, the cooking and heating peak seldom if ever synchronising with the lighting peak. The fear that heavy expenditure on new plant and on larger mains would follow immediately upon the opening of a campaign in favour of electric cooking and heating, has up to the present caused many engineers to hesitate before offering current for such purposes at *attractive rates*, but the fear is groundless. When the load for cooking and heating has risen to such proportions that new plant must be installed and larger mains laid down to meet the demand, the revenue from that load will justify the expenditure, even at the low rates at which energy is supplied. Larger outputs involve lower costs. Higher load factors have the same effect. The reduction in plant costs during the last few years has been great, and useful

economies are still being effected, so that as new sets of large output are needed, their cost per kilowatt will be substantially lower than they are even at present, while their efficiency will be higher, with lower running and maintenance charges. The demand for electrical energy for power purposes is enormous, and in many districts exceeds that for lighting. This load has been built up by offering cheap units and it has proved a profitable source of revenue for supply undertakings. But, large as it is, it will be as nothing compared with the load furnished by domestic electrical requirements provided that energy be offered at reasonable and competitive prices so as to bring the advantages of electrical operation within the reach of all classes of society. Manufacturers will be only too glad to produce apparatus in large quantities at prices infinitely lower than is possible at present, and this will still further encourage the use of electrically-heated appliances.

The introduction of the metal-filament lamp, owing to its lessened current consumption, caused in many districts a serious drop in revenue from the lighting units sold. In one of the London districts for example, a drop of £7,000 was recorded from this cause. In other areas the loss of revenue has been proportionately serious, and in several districts the loss has been made up by a greatly increased consumption and by the addition of new consumers, attracted by the cheaper cost of lighting. In view of the smaller return from individual lighting installations, it has become necessary to encourage the use of devices other than those used for lighting, and the development of the domestic cooking and heating load opens up immense possibilities in this direction. If a householder already be a lighting consumer, no new service is required, and if some comprehensive system of charging be adopted, the need for separate circuits and extra meters in many cases can be avoided, so that the initial cost of providing for this class of business is quite small. It frequently does not pay to run an expensive service merely to supply a few tungsten lamps of low candle power, but if the consumer avails himself of a cooker or heater, the revenue from his installation, even though it be from cheaper units, is a paying proposition.

In America comparatively high rates have been charged for

Electric Cooking, Heating, Cleaning
Etc.
Being A Manual of Electricity in the
Service of the Home
by "Housewife" (Maud Lancaster)
edited by E.W. Lancaster
London Constable & Co. Ltd. 1914
Copyright in U.S. D. Van Nostrand Co.
New York

ıgly heavy prices of gas,
a heating and cooking
s 1½ cents per kelvin or
ι some cases fixed at $1
1d. or 2 cents per unit,
tricts the rate is as low a

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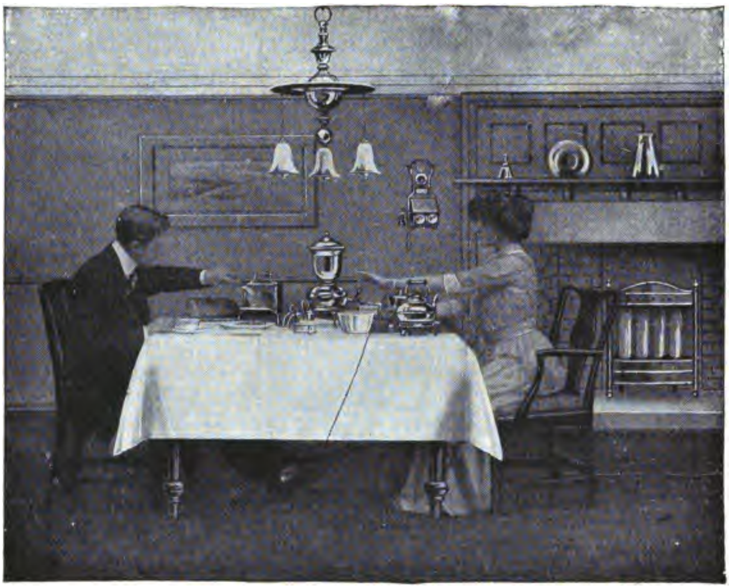
lectric Supply Company or
his own house equipped, so
various apparatus. *The*
Company or Committee)
of electricity for cooking
and heating before he can hope to ...erest his consumers in the subject. Without personal knowledge and experience, as well as enthusiasm, little good can be accomplished. There are many supply engineers who consider electric cooking and heating as beneath their consideration, and as not offering a paying proposition, simply because they have not troubled to test for themselves in their own homes the advantages of electrical operation for uses other than lighting. Let *every station engineer* and sales manager set up *his own cooking installation and supervise the tests himself.* If he carries out his experiments in a businesslike and scientific manner, he cannot fail to gain implicit confidence, and so to be in a position to impress his consumers with a belief in electrical operation for the kitchen, for enthusiasm is infectious,

and he will further be able to give first hand the results to his employers. No engineer should be content to wait for the demand for cooking and heating apparatus to come to him, but should take energetic steps to hasten and develop local interest in the subject, and this can most effectually be accomplished if he first becomes familiar, by personal experience, with the various domestic uses to which electricity may profitably be adapted. The field is enormous and if engineers will only take the trouble to go into the matter intelligently, and to study carefully *electrical cooking requirements* and the details of the various appliances on the market, they will realise that the golden opportunity has arrived and that the time is now ripe for pushing the use of electricity for many domestic uses undreamed of when lighting was the sole object of any electric supply undertaking. They must be alive to grasp and profit by the opportunity, realising that the wider applications of electricity will benefit not only their individual undertakings, but will alter for the good the lives of the people just as greatly as did the introduction of electric light and electric motive power.

The electrical press, both in Great Britain and America, is unanimous on the question. In America the " Electrical World " and in England the " Electrical Times " have especially identified themselves with the subject, and have done good work in bringing before the Central Station Engineer the true merits of the position. They have rightly pointed out the duty imposed upon him to see to it that his consumers avail themselves of all the advantages that electrical service can supply, and that it is of primary importance that he should familiarise himself first of all with every economical application to which electrical energy can be put in domestic and hotel life and industrial use. It is only a beginning to instal lamps for lighting in a house, although an important step in the right direction, and what is wanted is an educational campaign to bring home to consumers who merely use their installation for lighting that the good fairy of electricity can do greater things than these for them. The technical press is doing its level best to arouse engineers to the importance of the subject; the manufacturers are doing all and more than can be expected from them, and it remains for the supply engineer to

use the material available and carry out the good work in his own district. Having taken off his coat to the work, he will have no cause to look back, and he can rely upon the cordial co-operation of everyone interested. There is ample scope for energy and enterprise; and a rich harvest, in the shape of improved load factors and increased outputs, awaits those engineers who have the courage to test these problems practically, *not* experimentally, and open up a campaign of combined publicity, on a commercial basis in favour of electricity for lighting, cooking, heating and the many other uses in every home.



Breakfast in the Modern Home.
Apparatus by the General Electric Co. (England).

WHY ELECTRIC COOKING IS IDEAL AND BEST

Electricity gives the following advantages when used in the breakfast-room:

Table Control of Light Cookery. For breakfast and tea, the water for making the tea or the percolator for the coffee can be switched on at any time and the tea, coffee, toast and other light cooking can be done within a few minutes on the table, free from smell or dirt.

In this way the tea, coffee and toast are delightfully fresh and hot. Then if an omelette or bacon is required, it can be cooked and served fresh and hot by the housewife without troubling the kitchen. Eggs can be placed in water *just boiled* on reaching the table, and they will be cooked to perfection in 6 or 7 minutes, or if required harder may be left in for 10 minutes. It is quite unnecessary, as I have previously pointed out, *to "boil" the water while the egg is in.*

The chafing dish is also very easily operated at the table and many dainty little things that have been prepared hitherto in the kitchen may be cooked to perfection in a few minutes at the table.

The porringer for example is better heated in the room where the porridge is to be eaten, while tomatoes, kidneys and such like may be very nicely grilled at the table, and served to perfection.

All that is necessary for very economical and pleasant table

cookery is to have a cooking and heating circuit run to the breakfast or dining-room and one or more connectors fitted conveniently near to the table or sideboard, the devices themselves being supplied with current through flexible wires.

Ease of Operation. Electricity gives the following advantages for the kitchen:—The required heat is available immediately by simply turning on the switch or switches, and the object

Preparing Dinner with the Electric Cooker. (G. E. Co., England).

to be cooked can be maintained at *the proper temperature throughout* with the greatest ease.

Concentrated and Constant Heat. The heat is concentrated on the cooking and not taken off by heating other parts of the range, or wasted in the flues as in the case of a coal fire, or in heating the continual inrush of cold air as in the case of a gas cooker.

Comparisons with the Present Gas Cooker. No Poisonous Gases. No bad Odours. Owing to the necessity of giving a supply of fresh air to the gas burners and getting rid of the

poisonous gases and flames, it is necessary to have a large vent to the gas oven, through which these gases can be given off to the outside air. The oven, therefore, is turned into a *flue* and the cooking is done *in the flue.* A large part of the savoury juices of the meat is thus carried away by the hot poisonous gases through the vent to the outside air. If there is no vent pipe the whole house is filled with both the fumes and the odour of the burnt fat and juices.

Cool Kitchen. The heat being concentrated where it is required, the kitchen is not in any way heated or the air polluted, an advantage of the greatest value at any time from the points of view of health and comfort, but of supreme importance in hot weather, when the ordinary kitchen becomes unbearably hot and stuffy.

Clean Kitchen, Saving of Dirt. There being no coal, cinders or other material brought into the kitchen for the cooking, there is therefore no dirt or dust, the electric cooker creating no dirt.

Saving of Labour. It is obvious, therefore, that a very large amount of labour is saved.

Saving in Cost. Then there is the saving in cost of food, because a larger joint is available after it is cooked by electricity, and the value of the increase in size of joint over a similar one cooked by the present coal or gas methods represents a substantial saving. At the very least 15 *per cent* in the weight of cooked meat is thus saved, and this figure is proved by the tabulated statements and curves which I am able to give on later pages, taken from actual tests. Fifteen per cent from the butcher's bill for the year means to a very small household, spending only 10/- or $2.50 a week on meat, or £26.0.0 ($130) per annum, *a saving of* £3.18.0 or nearly $20 a year; then there is the ease with which electricity can be operated and regulated, all of which would go towards making the cost considerably below that of other methods of cooking.

Increased Value. Another important item is the increased value in the cooked joint, for it is always found to be more tender, better flavoured, and therefore more enjoyable.

Other Cookery Objects Improved. In addition to the foregoing advantages, there are also considerable advantages and

savings in the cooking of pastries, milk puddings and many other things in which the oven only serves; all these are improved, and cooked to perfection, with less anxiety and trouble to the housewife or cook. After a little practice, she will know absolutely that an object put into the oven with a given switch or switches turned on, will be properly done at a given time. The cooking can be left to the maid with instructions that the switch is to be turned off at a given time. In the case of a small household where the automatic and clock-controlled cooker, which has recently been introduced, is installed, the cooking is started by the clock and controlled automatically either by the temperature or by the clock or by both as desired.

Last but not least it gives the mistress of a household, the true " housewife," a thorough *grip* and *control* of the chief domestic duties of her home.

SCIENTIFIC OPINIONS ON THE CORRECT METHOD OF COOKING

That the Electric Form of Cooking is the Ideal and Best is demonstrated by the highest scientific authorities on *Food* and *the Chemistry of Cooking,* such as Sir Henry Thompson, Dr. Thudichum, Dr. R. Hutchison, Dr. Matthieu Williams, Dr. J. G. McKendrick, etc., etc. All these authorities have for many years advocated the cooking of foods by *uniform moderate temperatures,* and point out that the best results are obtained when the food is cooked *slowly* with moderate and *even* temperature throughout. In the case of Roasting or grilling meats, the temperature should be *high* for the first *few minutes,* sufficient to seal the meat only, being afterwards reduced and kept at a lower temperature throughout. With " *boiled* " meat it is important that the liquid *should* be at *boiling point* (212° Fahr.) when the meat is put in, but should *not* be at boiling point *during the cooking,* but at a temperature of about 180° Fahr.

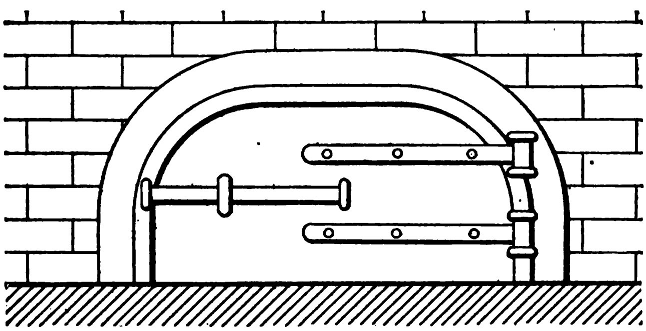
It is impracticable for the ordinary housewife or cook to do this with a coal cooking range or gas cooker. This is proved by records of the many attempts of scientists and inventors to introduce special cooking stoves and utensils with the object of maintaining a uniform temperature under all conditions of firing, etc., during the process of cooking.

SHORT HISTORICAL SKETCH OF PROGRESS AND EXPERIMENTS IN COOKERY

Cooking by Heat Storage analagous to Electric Cookery. The method of cooking in ancient days was to dig a deep hole in the ground and to tunnel a chamber in the form of an arched oven. Into this the fuel was placed and burnt until the earth and stones surrounding the chamber were very hot; the chamber was then cleared of the remains of the fuel and the objects to be cooked were placed in it, the opening being sealed with stones and earth. The heat stored in the walls of the chamber was sufficient thoroughly and properly to cook all that was required, but it was usual to leave the food in the oven for many hours, since, owing to the comparatively low and uniform temperature, there was no possibility of the food being burnt, or a likelihood of its being over-cooked. This method is in use at the present day in some uncivilized parts of the world, and even in our own country by gipsies and military camps, the food being better cooked than is possible with any other system, except electricity.

On a visit to Pompeii, I was most interested to find the bakery and some cooking chambers still in perfect condition. The method of cooking employed by the Romans over 2,000 years ago must have given results similar to the ideal methods suggested by Count Rumford and others. The baking oven employed and now visible at Pompeii consists of a chamber built of earthenware slabs, and shaped very much like the bakers' brick ovens seen in country places in England. It has a flat bottom and an arched top, the bottom built of square earthenware slabs and the sides and top of smaller pieces, filled in with fire-clay. The chamber was heated by wood or charcoal put into the oven itself, and in a furnace beneath the chamber, the whole chamber being heated uniformly. Small objects were cooked first quickly and the larger objects later, when they could be left in the uniform heat for a long time.

Count Rumford, a most remarkable man, was no doubt the first scientific and practical cook. He was, as Benjamin Thompson, an apprentice boy in Massachusetts (U. S. A.), and became a School-master; then a Diplomat and British soldier as Colonel Sir Benjamin Thompson; then the Military Dictator of Bavaria as Count Rumford; afterwards the Philosopher and Founder of "The Royal Institution," London. In his "Essays" on "The Feeding of the Poor of Munich and the Bavarian Army," he states:—"I constantly found that the richness or quality of soup depended more on the proper choice of ingredients and the *proper management of the fire* in the combination of these ingredients than upon the quality of solid nutritious matter employed.



Sketch of Roman Cooker and Bakery at Pompeii.

Much more depended upon the *art and skill of the cook* than upon *the sums* laid out in the market." It is clear that he referred to the art of *slow cooking* with *uniform temperature.* In describing the cooking of a shoulder of mutton he states:—"I had long suspected that it could hardly be possible that precisely 212° (temperature of Boiling water) should be the best adapted for *cooking all sorts of foods;* but it was the unexpected results of an experiment that I made, with another view, which made me particularly attentive to this subject. Desirous of finding out whether it would be possible to roast meat in a *machine that I had contrived for drying potatoes,* I fitted it up in the kitchen in the 'House of Industry' at Munich. I put a shoulder of mutton into it, and after attending to the experiment for 3 hours, and

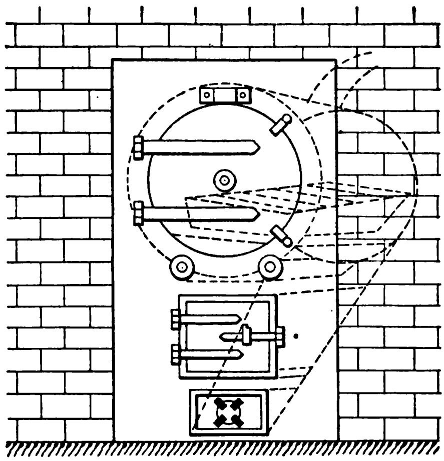
finding it shewed no signs of being done, I concluded that the heat was not sufficiently intense, and despairing of success I went home and abandoned my shoulder of mutton to the cookmaids. It being late in the evening and the cookmaids, thinking perhaps that the meat would be as safe in the drying machine as anywhere else, left it there all night. When they came in next morning to take it away, intending to cook it for their dinner, they were much surprised at finding it *already cooked* and not merely eatable but *perfectly well done* and most singularly well tasted. This appeared to them the more *miraculous* as the fire under the machine was quite gone out before they left the kitchen to go to bed, and they had locked up the kitchen when they left and taken away the key!

"This wonderful shoulder of mutton was immediately brought to me in triumph, and though I was at no great loss to account for what had happened, yet it was quite unexpected, and when I tasted the meat, I was very much surprised indeed to find it very different, both in taste and flavour, from any *I had ever tasted. It was perfectly 'tender.'* It did not appear to be the least sodden or insipid; on the contrary, it was uncommonly savoury and high flavoured."

That Count Rumford was a very practical man is shown by the incident of his feeding the poor of Munich, how he organized the capture of all the beggars of Munich on January 1st, 1790, when they were just about to inflict their usual New Year's Day *blackmail* upon the most thrifty and industrious of the population; having captured them how he trained them into becoming good citizens by kindness and good feeding. He made them *happy*, first by giving them food *properly cooked*, clean quarters and kind words—virtuous afterwards, by making them self-supporting. The returns state that a *net profit* of 100,000 florins was made during this experiment after expenses of every kind had been deducted.

A Rector of a midland parish with whom I stayed as paying guest for some few weeks many years ago, insisted on every member of his household going to Church morning and evening on Sundays. Yet he delighted in having hot meals. The cook, therefore, under the supervision of the Rector's wife, had all the

cooking preparations completed either on the Saturday or early on the Sunday, and immediately after breakfast, the cooking for dinner was commenced, and the heat moderated. Meat, vegetables and puddings were afterwards left on the *hot coal stove* for *two* hours to "*cook themselves,*" and it was remarkable that on Sundays the food was always better cooked and of better flavour than the usual week-day meal, when the cook kept everything at a high temperature and continual inspection.



Sketch of Count Rumford's Cooker.

Referring again to the work of Count Rumford, during 1803, about the time he was founding the Royal Institution, he was busily engaged in experimenting with a new form of oven he had invented. He pointed out the fallacy of roasting meat on a spit in front of a hot fire, which burnt the joint on one side and chilled it on the other. He proved by his new oven that food cooked in uniform heat was better in every way than that cooked by the extravagant method in front of the fire. His oven was the predecessor of the present coal cooking range, although many important details in design for uniform and moderate temperature have been overlooked and neglected. The economical and satisfactory results obtained by Count Rumford were produced by uniform heat.

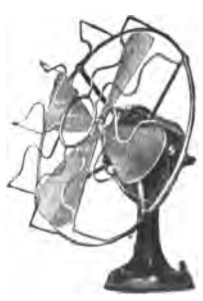
Mr. Matthieu Williams, in his book "The Chemistry of Cookery," gives several additional interesting accounts of Count Rumford's work, which are well worth reading. He also gives us the following:—

"*The Boiling of Water:* Next to the boiling of water for its own sake, comes the boiling of water as a medium for cooking

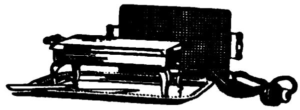
other things. Here, at the outset, I have to correct an error of language which, as too often happens, leads by continual suggestion to false ideas. When we speak of 'boiled beef,' 'boiled mutton,' 'boiled eggs,' 'boiled potatoes' we talk nonsense, we are merely using an elliptical expression as when we say 'the kettle boils,' which we all understand to mean the contents of the kettle, but we are expounding a false theory of what has happened to the beef, etc., as false as though we should describe the material of the kettle that has held boiling water as boiled copper or boiled iron. No boiling of the food takes place in any such cases as the above-named—it is merely *heated* by immersion in boiling water; the changes that actually take place in the food are essentially different from those of ebullition. Even the water contained in the meat is not boiled in ordinary cases, as its boiling-point is higher than that of the surrounding water, owing to the salts it holds in solution.

"Thus, as a matter of chemical fact, a boiled leg of mutton is one that has been cooked, but not boiled, while a roasted leg of mutton is one that has been partially boiled! Much of the constituent water of flesh is boiled out, fairly driven away as vapour during roasting or baking, and the fat on its surface is also boiled and more or less dissociated into its chemical elements, carbon and water, as shown by the browning due to the separated carbon." [1]

[1] "Chemistry of Cookery," by W. Matthieu Williams. Published by Chatto & Windus, London.



An Electric Kitchen. (British Prometheus Co.)



MODERN COOKERY

As regards good cooking, we certainly are not improving either in Great Britain or America. The general conception of cooking is reaching a *lower* level, not a higher one. And why? We want our cooking to be accomplished in the same *mad-like rush* in which we do everything else! And what is the result? Impaired digestions, bad health and chronic dyspepsia!

A reformation must take place amongst housewives and cooks! and it will not be accomplished in a day. " More haste is less speed," and when we have learned to realise that " slow Cooking " is absolutely the very best, and really takes less time in the end, we shall refuse to taste food cooked in the style of the present day. How often we find good beef and mutton overdone or hard through over-heat in cooking!

A celebrated chef, who is one of the Judges at cookery exhibitions and Consulting Chef to several of the best hotels, said to me a little time ago:—" I do not understand how it is that English and American housewives cook their meats so badly. In England and America they have the best meats in the world, yet it is usually very badly cooked; not only is roast meat overdone, but ' boiled ' and stewed meats are over-' *boiled*,' while on the continent, where the meat is dear and bad, they cook the meat slowly, economically and to perfection."

I have said that cooking is deteriorating in the English-speaking nations, and in no dish is the decadence of cooking more palpably shewn than in soups. The tasteless, watery liquids made up for soups are a disgrace to us.

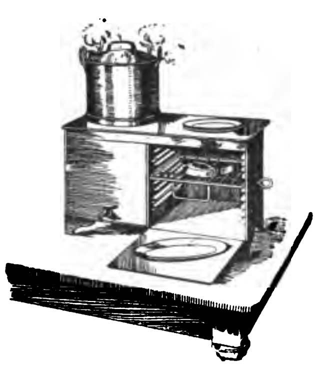
For instance:—A " consomme " according to French culinary art is a strong liquid obtained by stewing vegetables and meat and concentrating the extract until it browns slightly—it is

then strained and clarified. Do we trouble to extract, or clarify? No! The example I have given is one of many soups, for which French cooking has become noted. Only rarely does one taste a good "purée."

In "Ragouts," we have made no progress—yet most dainty and nutritious dishes can be made economically. In soups, ragouts, and similar dishes (in fact, in all good cooking) the basis is "Savour." Yet we are all losing it in our mad rush and low tastes.

Again, the good old English puddings are gradually disappearing from our *so-called* high-class cooking; except in private houses with old traditions—yet they are positively invaluable to all young, growing people.

Omelettes we hardly know *how* to make. Pancakes are almost a lost art, for instead of being very thin, light brown and crisp, they are thick and heavy. Roast meats, on the whole, are about the same, and as I have already stated—too often is the leg or shoulder of mutton underdone, and the good old Roast Beef done too much. I wish to impress this thoroughly upon my readers, because, to make *use of Electricity in the best possible manner* is to put it to the perfection of work. How shall we get this perfection? Let us first see the reason for all this cooking.



WHY WE COOK

A Brief Outline of the Chemistry of Cooking. Food is cooked mainly for a twofold purpose:—*Aesthetically* to bring out new flavours and make it of pleasing and appetising appearance for the table, and *Hygienically* to enable it to be kept for a longer time in a somewhat sterilized condition.

Cooking also enables the right foods to combine in their proper proportions for the needs of the body, renders mastication easy, and hastens digestion, eliminates harmful foreign elements, and makes certain substances more nutritious.

The ordinary process of cooking is to apply heat in some form to the different chemical constituents of food.

Proteids of food *coagulate* at a temperature of 170° Fahr. *Carbohydrates* of food *gelatinise* at a temperature of from 140° to 190° Fahr. It will be seen that the change takes place below 212° (the boiling point of water).

The starch in the food is converted by the heat into a soluble form and ultimately into dextrine. This change partly occurs in the crust of bread and in making toast. Sugar is partially converted into caramel, and thus the flavour of the food is improved by the cooking.

In the cooking of meats—the main idea is to decompose the (haemoglobin) red colouring matter, and to remove the raw appearance, but this should be done without overcoagulating

the solid *proteids* or removing the (extractives) flavouring ingredients. This requires some care, and *high temperatures should be avoided.*

Roasting or Baking. In this form of Cooking the meat is usually subjected to the direct radiation of heat, so that the proteids coagulate. High temperatures should be avoided except at the first exposure, when a sufficiently high temperature, 250° to 300° (Fahrenheit) should be maintained for five or ten minutes to coagulate the surface and so to seal it and prevent the escape of the water vapour produced in the fluids. With a thin piece of meat the high temperature to which it should be first exposed not only seals the surface, but coagulates the proteid throughout and practically cooks the meat at once. When a chop or steak is cooked by grilling, the completeness of the sealing may be seen by the fact that the meat assumes a puffy form, showing that the water vapour produced from the fluids in the meat is unable to escape, and therefore expands. This causes the puffy appearance which is so pleasing to the expert cook as a sign of good cooking.

Large joints require exposure to a lower temperature for a longer time—the time varying according to the size. Roasting or Baking, if performed as directed, not only prevents the escape of the natural flavours of the meat, but develops them, making them more palatable. This is due to a change which it brings about in the extractives analogous to the alteration which sugar undergoes in its conversion into caramel.

Boiling. The immersion of meat into Boiling water, 212° Fahr., and subjecting it to a constant temperature of about 180° Fahr. is wrongly termed "Boiled" meat. The sudden immersion seals the surface of the meat in a similar manner as indicated with roast or baked meat, but as the red colouring matter is decomposed and rendered brown at a considerably lower temperature than that of boiling water, the continuance of the boiling after *sealing* tends to harden the meat by over-coagulation of its proteids. It is very desirable in all cooking, as before indicated, to retain and preserve all flavouring constituents of the meat. This demands some care, as the extractives and salts giving the flavour are readily dissolved by water.

It is necessary, therefore, to see that the water is maintained at a fairly constant temperature of about 180° Fahr. during the rest of the time needed to complete the cooking, unless the water in which the meat is cooked is to be consumed in the form of broth or soup, in which case the flavouring ingredients need to be extracted, and the water should not be boiling when the meat is first put in.

When the meat itself only is to be consumed, the water should be sufficient just to cover the meat. The water should be boiling when the meat is first immersed, but soon afterwards the temperature of the water should be lowered by reducing the current passing through the heating elements, easily effected by means of the regulating switches attached.

The cooking should then be continued slowly.

Stewing. For retaining all the flavouring ingredients, this is the best method of cooking, and should be very slow, with a temperature not exceeding 180° F. The prolonged action of heat and moisture converts most of the connective tissues into gelatine, so that the fibres readily fall apart, and the meat becomes very tender. Success is *attained only* by maintaining a moderate temperature as indicated.

Frying. Frying is the subjecting of a small piece of meat or fish to a high temperature in a shallow pan, which has the effect of producing an immediate coagulation of the proteids right through. It is, however, a very unsatisfactory method of cooking, and may with advantage be replaced by grilling, *broiling* or by the chafing dish.

Frittering (often mistaken for Frying, or vice versa). Frittering is the sudden immersion of the object to be cooked (such as meat, cutlets, fish, etc.) into liquid fat or oil at a high temperature, 300°–350° F. This, like the roasting or baking, has the effect of producing an instantaneous coagulation of the proteids on the surface, and a slight degree of charring. The soluble substances in the meat or fish are prevented from escaping, and owing to the complete immersion at the high temperature, the food is cooked throughout almost instantaneously.

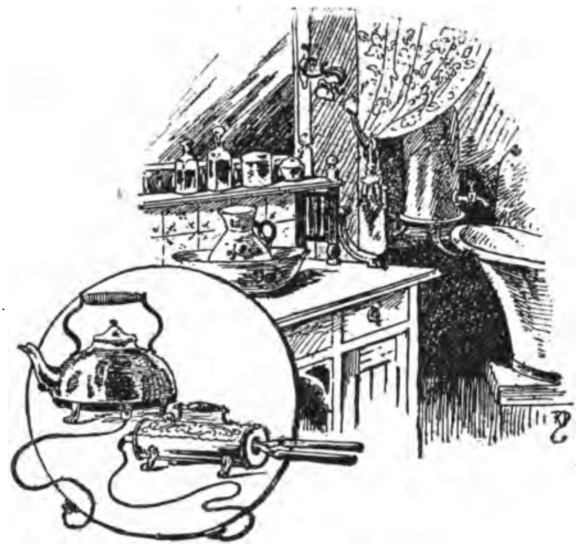
The pan should of course, be deep enough to allow ample oil or fat to cover the article to be cooked. The sudden plunging

into the hot fat or oil causes a good deal of spluttering, due to the immediate conversion of the surface moisture into steam. When the spluttering has ceased, the cooking will be complete.

Vegetables. The objects to be accomplished in the cooking of vegetable foods are, the softening and breaking up of the cellulose and the gelatinisation of its starch so as to render it more digestible and palatable, and therefore somewhat different treatment is required from that of meat. Green vegetables should be plunged into boiling water and kept at that temperature until they are cooked; potatoes and cereals require to be cooked slowly, at less than boiling point, as they gelatinise at from 149° to 190° Fahr.

Food, a Non-conductor of Heat. It may be, perhaps, better understood when it is pointed out that *Food* is a *very bad* conductor of heat, hence the heat travels into it very slowly. Sir Henry Thompson, in his experiments on the temperature inside pieces of meat, found that after a leg of mutton had been kept in boiling water for some hours, the temperature of the meat inside near the bone never exceeded 187° Fahr. The same result was found in the case of a leg of mutton roasted. The interior of a piece of meat varies from 160° to 195° according to size.

With this brief outline of the principles of the Chemistry of Cooking let us now see how electricity will help us and what apparatus there is available.



Dowsing's Electric Heating Apparatus, 1894.

Short Account of Electric Heating and Cooking from 1890 to 1914. It may interest my readers to know that experimentally, the fact that electricity could be applied to cooking operations was demonstrated by Franklin so long ago as 1749, simple operations being carried out with currents furnished by extremely primitive means; more than a century before the invention of the dynamo for generating electricity on a commercial scale. In 1891 Mr. H. J. Dowsing, M. I. E. E., one of the pioneers of Heating and Cooking and founder of the Dowsing Radiant Heat Company, had a stand at the Crystal Palace Electrical Exhibition at which were shown Electric Cookers and heaters. He certainly had far-seeing ideas. I am not going to advocate that the hot plate at top of the electric cooker, and that other apparatus shown should be *now* made in the forms they were at that Exhibition, but certainly Messrs. Crompton, who were responsible for the manufacture of these articles, fully grasped the possibilities of Electricity being applied for perfect cooking in the future! I, alas! had not the pleasure of being a guest at the first Electric Banquet given to the Lord Mayor of London at

The City of London Electric Lighting Company, Limited.

BANQUET COOKED BY ELECTRICITY

AT THE

CANNON STREET HOTEL,

ON

Friday, 15th June, 1894.

Sir DAVID L. SALOMONS, Bart., M.A., A.Inst.C.E.,
(Vice-President of the Institution of Electrical Engineers)
IN THE CHAIR.

Directors:

THE RIGHT HON. THE EARL OF SUFFOLK & BERKSHIRE.
JOSEPH BEVAN BRAITHWAITE, ESQ., M.INST.E.E.
COLONEL B. H. MARTINDALE, C.B.
F. W. REYNOLDS, ESQ.
EDWARD LUCAS, ESQ.

Engineer and Manager:

DAVID COOK, ESQ., M.INST.C.E., M.INST.E.E.

Secretary:

JOSEPH CECIL BULL, ESQ., A.INST.E.E., F.I.S.

Solicitor:

WILLIAM MORRIS, JR., ESQ.

Consulting Staff:

PROFESSOR A. B. W. KENNEDY, F.R.S., M.INST.C.E.
PROFESSOR S. P. THOMPSON, D.Sc., F.R.S.
PROFESSOR J. A. FLEMING, D.Sc., F.R.S.
COLONEL H. C. SEDDON, R.E. (Retd.)

the Cannon Street Hotel, with Sir David L. Salomons in the chair, on June 15, 1894, but I give you a copy of the original Menu (kindly lent me by Mr. Dowsing), and he assures me that the Banquet, which was cooked entirely by electricity, was quite a success.

MENU.

Hors D'Œuvres.

Soups.

Clear Turtle. *Thick Turtle.*

Fish.

Fillets of Soles Cardinal.

Salmon and Hollandaise Sauce.

Whitebait.

Entrees.

Cailles en Caisses Perigeux.

Ris de Veau aux Petits Pois.

Remove.

York Ham, Madeira Sauce.

Joint.

Fore Quarter of Lamb.

Peas. *New Potatoes.*

Roast.

Ducklings. *Chips.* *Salad.*

Asparagus Sauce Mouseline.

Sweets.

Windsor Pudding.

Charlotte Russe. *Liqueur Jelly.*

Ice Pudding.

Dessert.

Cafe Noir.

Six large ovens and a number of smaller utensils were fitted up in one of the outer rooms near the dining-room where the dinner was served.

Visitors were enabled to see the cooking operations in progress and to note particularly that owing to the absence of smoke, dust and fumes, there was little objection to the cooking being carried out even in the dining-room itself.

In 1895, Colonel R. E. Crompton read a paper before the Society of Arts on the use of Electricity for Cooking purposes and a large variety of cooking appliances was then shown in use.

The year 1890 may, however, be taken as the date at which the first practical attempt was made to introduce electrically heated cooking apparatus. During the last decade of the 19th century, much progress was made in the design of cooking utensils, and so far as their construction went, they were already practicable though not very reliable. I have already referred to the pioneer work of Mr. Dowsing, on behalf of Messrs. Crompton, and their enterprizing ideas materialised in the production of serviceable hot plates, self-contained water heaters, frying pans, and so forth, from which all present day cookers have been evolved. Col. Crompton is worthy of special mention for his early labours in electric lighting, heating and cooking. The enterprize of inventors and manufacturers, however, received little encouragement for many years, for electricity was only supplied in those days at prices which made electric cooking and heating prohibitive, except in special circumstances. Current could not be obtained more cheaply than 8d. per unit for many years, and the general public naturally felt little interest in cooking and heating appliances which cost many times as much to use as those with which it was familiar, to say nothing of the heavy initial charge made for the utensils themselves. It was only when it had been proved by the results of many years' working that it was possible commercially to supply energy at cheap rates for power purposes, that engineers thought it worth while to adopt a similar system of charging for current used for cooking and heating.

As I have already stated, there are quite a number of districts in which current can be obtained for ½d. or 1 cent per unit in

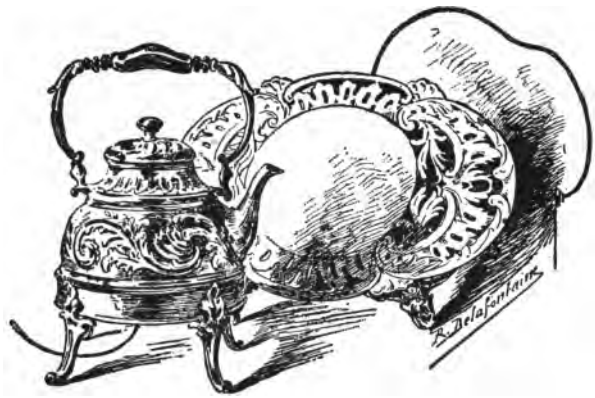
England and 3 cents in America and many others in which 1d. and 5 cents respectively is charged, and at these figures the operating costs of electric cookers and heaters will bear favourable comparison with coal and gas. When it is considered that there were persons who so appreciated the advantages of electrical operation that they were willing to pay 8d. per unit for current used by radiators and cookers, it is not surprising that the public as a whole is becoming keenly interested in the more efficient and reliable apparatus now on the market, which will afford all the advantages of the earlier types at prices very considerably less, and can be operated at an eighth and even at a sixteenth of the cost involved ten or fifteen years ago. In this connection it is important to bear in mind that even the low prices available to-day do not represent the final minimum, for as the number of users increases, and still larger supply stations are erected, the charge made per unit may be reduced yet further. There are indeed competent authorities who say that within a reasonable period we shall only have to pay in some districts .25d. or $\frac{1}{2}$ a cent per unit for our electricity, whether it be used for lighting, for power, for cooking, heating or any other purpose. Needless to say that at such a price, or anything approaching it, it would not pay any householder, from the artisan at £1 a week to the largest hotel proprietor, to employ anything but electricity for every purpose to which it could be adapted.

In the early days, there were many technical difficulties to be surmounted by pioneers in electric cooking and heating. The greatest trouble was to obtain a suitable resistance material to serve as the heating element. At first platinum wire was tried, but this, although satisfactory in many respects, was too costly for commercial application. Alloys of iron in the form of wire were found to be more convenient and infinitely cheaper, but they oxidised by contact with air and moisture and quickly burnt out when this occurred, while they could not safely be operated at temperatures high enough for many cooking operations. In order to protect them from atmospheric influences, manufacturers embedded their spirals of wire alloy in a special enamel, and this proved fairly satisfactory, although the difference in the rate of expansion of the metal and its surrounding enamel caused the

latter to fracture and so to admit air and moisture, with consequent early failure of the heating unit. Improvements were made, however and a wire introduced which, while not embedded in enamel, was to a great extent proof against oxidisation and chemical action, and such wires are still employed in some systems, supported on insulators and exposed to the air. They are used more particularly for grills and ovens, but many kettles and other self-contained utensils, fitted with heating elements of plain wire in which iron is the principal ingredient, are still giving satisfactory service. A great advance, and one which has practically revolutionised the industry, was the introduction of nickel wire and of an alloy of nickel and chromium, known as nichrome. This remarkable wire can be run at a bright red heat for long periods without any deterioration taking place; it is to a great extent proof against chemical action and oxidisation; it is unaffected by the frequent switching on and off and by violent fluctuations in temperature and is quite cheap. Practically every maker of cooking and heating apparatus employs this wire, or one of similar nature, and its adoption has made possible the production of devices which are low in first cost, reliable in operation, and most efficient in current consumption. There are several other types of heating element on the market (to which reference is made at the section explaining technical terms, and under the heading "heating elements"), and I have heard of others which are about to be introduced, but the heating unit of to-day is a thoroughly sound and satisfactory part of the electric cooker and heater and gives little trouble. In the event of a breakdown it can be replaced at small cost and with little trouble, by the aid of a screwdriver and common sense, most makers providing for easy replacements when designing their cookers.

The following illustrations are reproductions of some of the cooking and heating devices shown at the Crystal Palace Exhibition of 1891 by Messrs. Crompton & Co. It will be seen that the designs of the heaters were most elegant. A range of electrically-heated appliances was placed on the market in 1894. Some of these are shown in the accompanying illustrations, and their appearance strikes one as being far from primitive, when com-

pared with those available to-day. They gave good results in practice, although the high rates charged for current at that time prevented their wide adoption. The General Electric Co. of Great Britain and the General Electric Co. of America, both, however,



Electric Kettle and Chafing Dish of 1891.

Electric Radiator of 1891.

Dowsing's Electric Kitchen of 1894.

realised that in time electric heating and cooking would develop into one of the most important branches of the industry, and they have continuously experimented with new apparatus which promised improvement upon existing types, and have ever kept abreast of the times. Another firm which entered early into the cooking and heating business was the British Prometheus Co., which since its foundation about 1892, has been engaged exclusively in the manufacture of electrically-heated appliances. Prometheus heaters and cookers have long established a reputation for reliability and efficiency, and the Company's extensive works at Birmingham are turning out kettles, irons, grills, toasters, ovens, cooking ranges and similar goods at an ever-increasing rate. The Phoenix Electric Heating Co. was, I believe, the next to launch out into the business, and since then this firm has done a great deal to develop electric heaters and cookers.

Perhaps the most familiar name to those interested in electric cooking is that of "Tricity." It was in 1908, I think, that Mr. A. F. Berry first placed on the British market the "Tricity" cooker. At that time there were very few electric cookers in general use, and Mr. Berry's device was a great advance upon existing designs. In its original form it could only be used on alternating current supplies, but the "Tricity" cooker of to-day can be used wherever a supply of current is available. Essentially

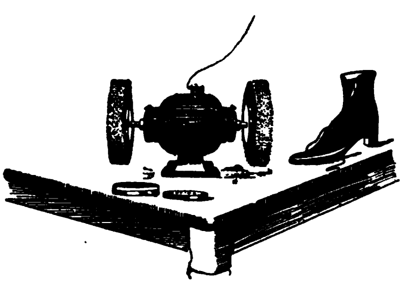
it consists of a circular hot plate of cast iron, with its working surface ground perfectly flat. On this disc, ordinary flat-bottomed vessels may be placed, but the makers advocate the use of special utensils with flanged bottoms, which give a higher efficiency. Attachments for use with the boiling ring include a silver grill, airing frame, large and small ovens, and many special devices, a second or extension ring being provided for use on the top of the oven and for heating additional utensils. Many thousands of "Tricity" cookers are now in daily service, and are giving satisfaction. To Mr. Berry is due the conception of the idea of developing the cooking business by giving practical demonstrations in public, and in conjunction with Messrs. Gillespie and Beales, the British Selling Agents for "Tricity" cookers, lectures have been given in hundreds of districts. These have aroused intense interest and have led not only to the adoption of electric cooking by many of those who witnessed the operations carried out so quickly and effectively with the beautifully clean "Tricity" cooker, but to the introduction of lower prices for electricity in a number of districts and to the inauguration of hiring-out facilities. Users in such districts can hire an electric cooker for a few shillings a quarter, exactly as they formerly did for a gas cooker.

During the last four or five years many other firms, already well known and respected in the electrical industry, have opened special departments for electric cooking and heating. In Great Britain these include The Armorduct Manufacturing Co., Ltd.; Benham & Sons, Ltd.; The Carron Co.; Eastman & Warne; The Electric & Ordnance Accessories Co.; The Electrical Co., Ltd.; The Falkirk Iron Co., Ltd.; Ferranti, Ltd.; The Jackson Electric Stove Co., Ltd.; Purcell & Nobbs; Simplex Conduits, Ltd.; Spagnoletti, Ltd.; and The British Thomson-Houston Co., Ltd., Bertram Thomas, while there are many others who have lately gone into the business and whose apparatus promises to give equal results to that supplied by firms who have been associated with this particular branch of the industry for a longer time. I am giving illustrations and details of some of the apparatus manufactured by the firms mentioned, and although the designs of many may be superseded in a few years,

the principle involved will be the same, and while there may appear very little difference in types they differ in several details. The demand at present on some of the makers is greater than they can supply. In Great Britain the tall gas cooker type will be largely replaced by the double-oven *Electric Cooker proper,* as it is quite unnecessary to copy the errors of gas or coal cooker practice.

In America the progress of Electric Heating and Cooking has been retarded by the same causes as in Great Britain, but within the last five years the benefits of Electricity have been realised and American Engineers and Manufacturers have as usual risen to the occasion and there are now on the American market new types of Electric cooking apparatus, some of which are quite novel in conception and design, while others have followed gas practice, but these will soon be superseded. The Electric heat storage system has caught on in some States, and very useful and efficient apparatus are being sold. Among the chief makers are: The General Electric Co., The Simplex Electric Heating Co., The Copeman Electric Stove Co., The Cook Stove Co., The Berkeley Electric Cooker Co., The Westinghouse Electric Co., The Hot-Point Electric Heating Appliances, The Prometheus Electric Co., The Western Electric Co., The Vulcan Electric Heating Co., The Hughes Electric Stove Co.

Illustrations and particulars of some of the various types of apparatus are given under their respective headings: Table Cookery, Cookers, Heaters, Water Heaters and other domestic appliances.



Progress During the Past Few Years. It is very gratifying to see the enormous progress that has been made by British and American Electrical Manufacturers and Contractors during the past *few years.* Complete equipments have been fitted in palaces, mansions, hotels, hospitals, colleges, convents, schools, clubs, banks, restaurants, and other large establishments in Great Britain, America, Africa, Australia, and other countries; several of the railways have adopted electric heating and cooking in addition to lighting, and some of the largest steamships and war vessels have been fitted with Electric Cooking and Heating apparatus, including the Royal yacht of H. M. King George.

It is also pleasing to note that some of the installations are very extensive and of great historical interest, such as the Bank of England, where 4 kitchens will provide for upwards of 2,000 persons daily, and Grosvenor House, for the Duke of Westminster. Old kitchens which have provided banquets for Kings are being equipped with Electric Cooking appliances. I am only able to give brief details of a few of the installations, chiefly choosing those where photographs of the equipment have been obtainable, such as The Old Ship Hotel, Brighton; The All-electric Hotel, Colorado, U. S. A.; The All-electric Restaurant, Torquay; The Polytechnic, London; Middlesex Guildhall, Westminster, London; Debenham's, London; St. Cyprian's School, Eastbourne; Pier Pavilion, Cape Town; The Empire Hospital, Westminster, London; Romano's Restaurant, Strand, London; B. & K. Restaurant, Earls Court Rd., London br.; Bunting's Restaurant, Norwich; Harvey Nichol's Restaurant, Kensington; Blackpool Tower Restaurant; Cavendish Restaurant, Derby.

In one small district in London there are nearly 300 complete electric cooking equipments in regular daily use, chiefly in private houses, also many in nursing homes and boarding houses, as well as flats. In another English town about 70 electric cookers are installed in private houses, many of these being occupied by artisans, while in a Sussex village of less than 1,000 inhabitants, cooking is carried out electrically in 38 households, many installations being in thatched cottages built 200 years ago.

Several English railway companies are now providing electric grills and cookers for the use of their employees whilst on duty.

ELECTRIC COOKING

The Ideal to be Aimed at. The oven and hot plates should attain the highest temperature required in the shortest possible time, and with the least possible amount of Electricity. The heat given off should be stored or conserved as long as possible. The low heat " Element " or " Elements " should be able to maintain the temperature required for the average cooking to which the apparatus may be subjected, or for which it is constructed.

The most perfect arrangement for the oven is an equal heat all over, coming from the sides, controlled by two or more switches, so that on the oven attaining the requisite temperature for the cooking required, the heat can be maintained by not more than a quarter or a third of the current needed to raise it to the requisite degree in the first instance.

The oven may be provided with means to see the progress of cooking without opening the door, lifting the heat cover, or allowing the heat to escape. A heat indicator or thermometer may be provided reading up to 600° Fahr. and a pilot or current indicator in the form of a drop red flag or a glow lamp may indicate that electricity is being used in the oven or any other apparatus. A glow lamp may indicate whether high, medium or low heat is being used.

Electric Cookers are the combination of oven and hot plates and really take the place of the " coal range." The Cooker may be made up of portable parts, comprising a chamber for baking, which, together with a boiling plate, may make up the oven, and this may be supplemented by one or more separate hot or boiling plates connected to the original cooker or detached; these together make up all the parts of the cooker. In other cases, the oven and hot plates may be combined in one apparatus similar to a gas cooker. Several of these are illustrated on pages 102 to 144.

Cookers either portable or fixed may be obtained suitable for cooking for any number of persons, from the lonely lady or bachelor to the " baker's dozen " or more.

The Cooker specially suitable for a small family may not be suitable for a large one, and indeed seldom is so.

It is absolutely necessary to have some standard form of cooker that will be suitable for the requirements of the locality and class of people catered for by the Supply Company, so as to facilitate the adoption of electric cooking without too great a contrast in the arrangement of the apparatus. For instance: in London, the low oven and small range is most general; in Leeds and Bradford, the Yorkshire or high oven is most in use; whilst in Manchester and Liverpool, the Lancashire form or medium height is generally used. The latter practice is also general in America.

For small families where the cooker has to be purchased outright or on the " hire purchase system," there is no doubt the portable sets have much to commend them. The hot plates can be used daily, whilst the oven need only be brought out when required for use. Plate warming can be very conveniently done in a small hot-cupboard, which takes a much smaller amount of electricity than is absorbed in an oven. Soups, stews, vegetables and boiled puddings can be done on the boiling plates. In this way a considerable saving can be effected; the oven only being used two or three days a week when baking or roasting is required. Owing to the storage of heat in the oven, cakes and other things needing a greater and quicker heat can be done in it to perfection.

For large families: it is best to purchase or " hire " a large outfit. The electric connections can be made so conveniently that the cookers need not be fixed in one position, but can be made so that the stove can be moved on wheels to any convenient part of the room, according to the requirements of the household or local conditions.

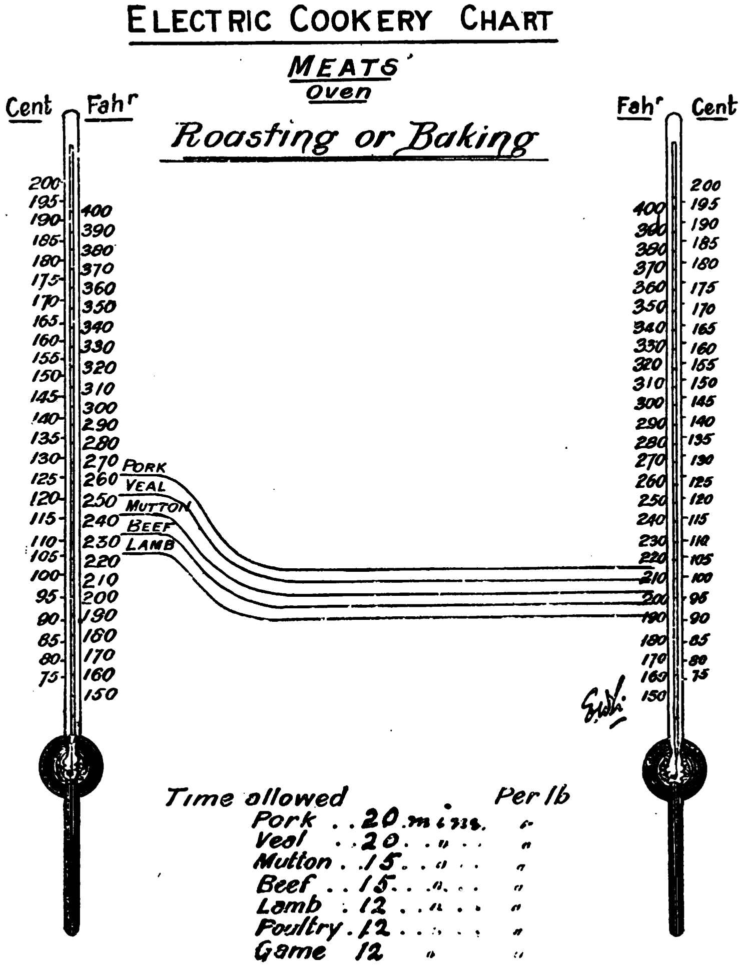
With very little extra cost, whilst the wiring is being done, additional connections can be fixed on the walls or other convenient places.

Where the cooking has to be left to the care of servants, a

heavier type of cooker is necessary so as to provide for rough handling—a strong design is essential, and in these cases, the oven should be protected by some form of heat-insulating material. In this case, it is preferable to have the oven designed in such a manner that if any liquid is spilt or vapour arises in or on the oven, it can in no way get to the material used in lagging the oven.

For this reason, the object at which all makers are aiming, or should aim, is to provide (at the least possible cost) an oven which can be quickly heated and will retain or store the heat given to it for as long as possible. The heating elements should be strong and easily replaced, and well protected from any possible contact with anything that may be put into the oven or with anyone operating it. Every part of the wiring, switches, fuses and plug connections should be protected from any possibility of contact with the person operating and from being touched by any knife, fork or other implement or utensil likely to cause a fault or short circuit. Many of the present apparatus both fixed and portable have terminals exposed to accidental contact and short circuit. These should be amended without delay. This applies to all apparatus on Electric supply circuits both portable and fixed.

"Eclipse" Breakfast Grill Toaster and Hot Plate.



The temperature indicated must be at the joint and the time allowed is after taking 20 minutes required for the first heat to seal the meat.

HINTS ON ELECTRIC COOKING

Roasting Oven. The left-hand thermometer on the Electric Cookery chart indicates the temperature at which the oven should be when the joint is put in. The proper temperature is usually attained in an electric oven by putting the switches all on at *high* for about 15 to 25 minutes according to the size and make of apparatus. After the joint has been in about 15 minutes, sufficient to *seal* the meat the switches should be turned to *low*, this usually being sufficient to allow the temperature of the oven to drop to between 212° and 190° and to maintain it at that temperature as shown by the right-hand thermometer. The time for cooking various meats is given on the chart, and curves showing the time taken are given on pages 60, 62 and 64.

Baking. For baking Bread, Cakes and Pastries. The oven should be raised to between 350° and 400° by the switches being full on at *high* and maintained at between 350° and 380° by the switches being at *medium*.

Electric "Boiling" and "Stewing." In cooking all meats, *except salt meats,* by immersion into boiling water see that the water is only sufficient to cover the meat. Plunge the meat in while water is boiling, then turn switch down to "medium" or "*low*," according to size of joint and apparatus. Keep the water just *under* boiling until cooked. The time to be allowed for cooking for joints about 2 lbs. is roughly one hour, and 15 minutes for each pound above up to 12 lbs., and 10 minutes per lb. above 12 lbs. Thus: 2 lbs. beef will require 1 hour; 4 lbs., 1 hr. 30 min.; 8 lbs., 2 hrs.; 12 lbs., 3 hrs.; 14 lbs., 3 hrs. 20 min.; 16 lbs., 3 hrs. 40 mins.

Ham, Bacon and Salt Beef should be put into cold water and brought to boiling, then the switch turned to "low"; the time must be taken after the water has *boiled,* as for other meats cooked in liquids.

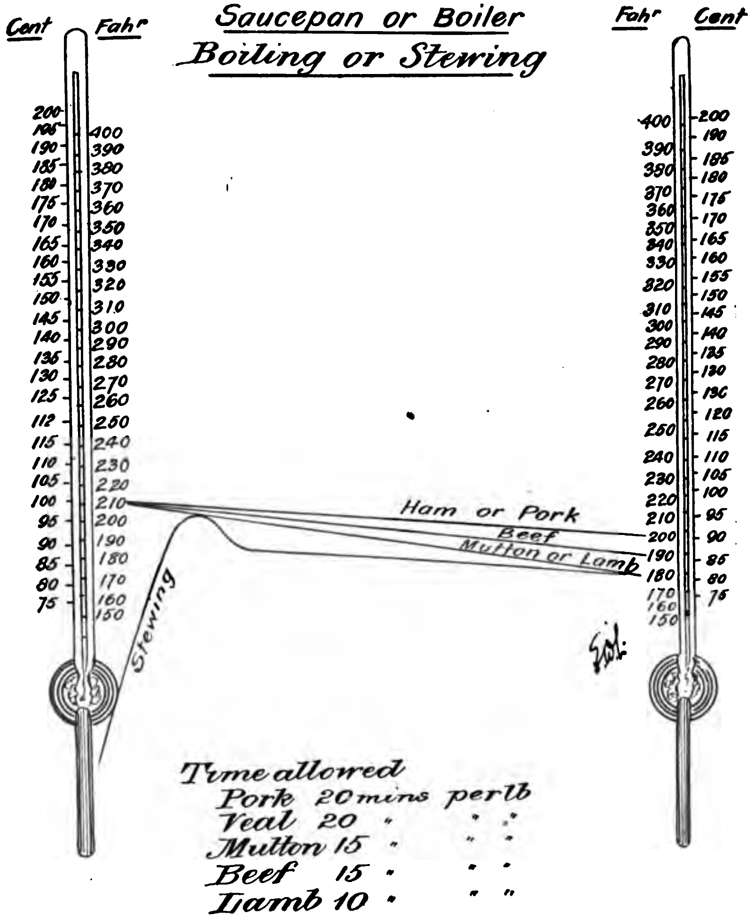
Stewing. For stewing, meats should be put into the stew-pot

ELECTRIC COOKERY CHART

Meats

Saucepan or Boiler

Boiling or Stewing



The temperature indicated is that of the liquid in which the joint is immersed and the time allowed after taking 20 minutes for the first sealing or bringing up to boiling point.

and just covered with cold water. The switch should be turned to high for about 20 minutes for small stews, and 30 minutes for large stews, to allow contents of pot to come to near the boiling point; then down to "medium" or "low," care being taken that the liquid never boils, but keeps at a temperature of 180° to 200° Fahr. Vegetables should be cooked separately and added to stew when cooked if required.

Fish. For boiling cutlets of fish, let the water be just sufficient to cover fish. Bring it to the boil; put fish in while boiling, and let it boil for 6 minutes for thin cutlets and 8 to 10 minutes for thick. The fish is done if it will come easily from the bone.

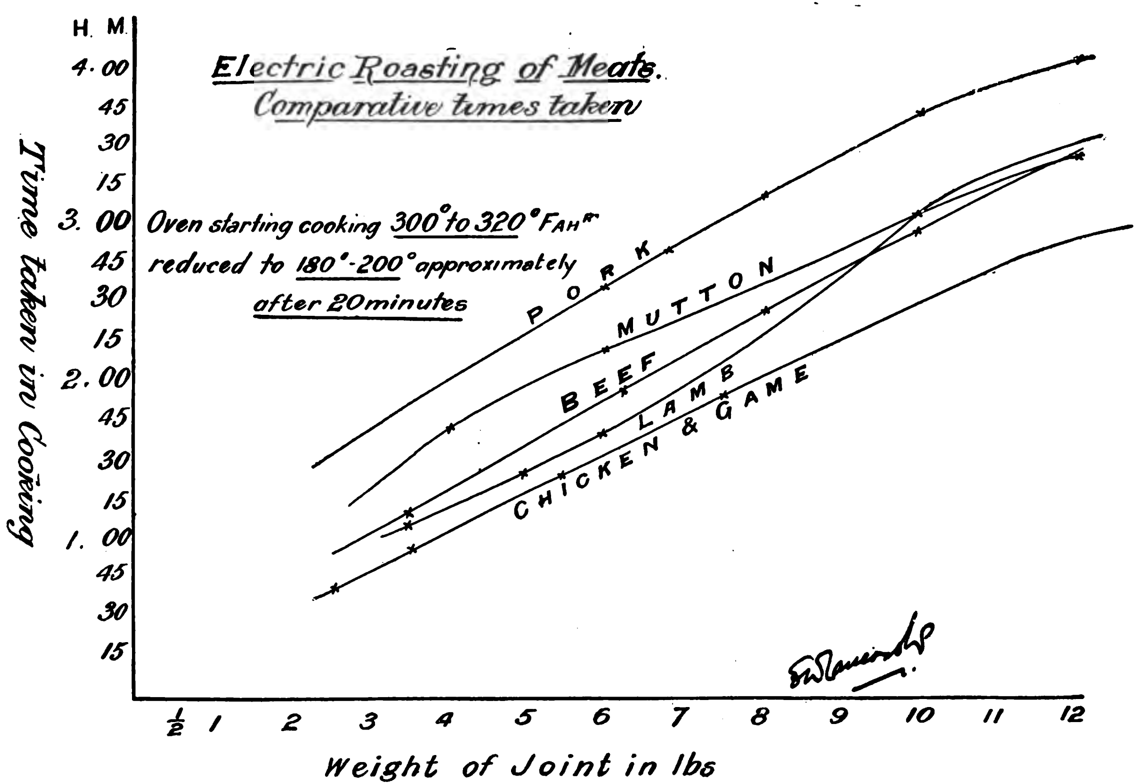
Electric Frittering. This is a process of cooking which is not sufficiently understood by the English-speaking housewife or cook. So many little dainty appetising dishes can be served up by this really very simple (when *once* understood) method of cooking. How often is the sole or plaice, or other fried fish or cutlets, sent to one's table reeking in unappetising fat, of an inartistic dark brown color, instead of being pale brown, crisp, and devoid of any appearance of fat?

The secret of frittering is a *deep* pan, and sufficient fat or oil in the pan *thoroughly* to cover the article to be frittered. It is essential that the fat should be heated to a temperature of 300–350° F. before the food is immersed in it, and a convenient method of testing the temperature is by dropping in a very small piece of bread. If it bubbles and remains at the top, one can gauge safely that the temperature is right. A great mistake is made by putting only a small amount of fat into the pan. Although it may appear extravagant to start frittering with say 2 lbs. or more of fat or oil, yet it is much more economical in the long run. One should always keep 3 frittering pans. One for fish, one for cutlets and savouries, and a smaller one for fruits and sweets. The same fat can be used over and over again; it should be clarified in the following simple manner:

Heat the fat, then pour it into hot water. Stand until cold, when the fat should be removed.

Always have some finely crushed and sifted bread-crumbs of a palish brown colour in an air-tight tin.

Any odd crusts or pieces of dry bread can be used for this



The Temperature Given to be at that Part of the Oven at the Grid or Tray upon which the Joint Rests.

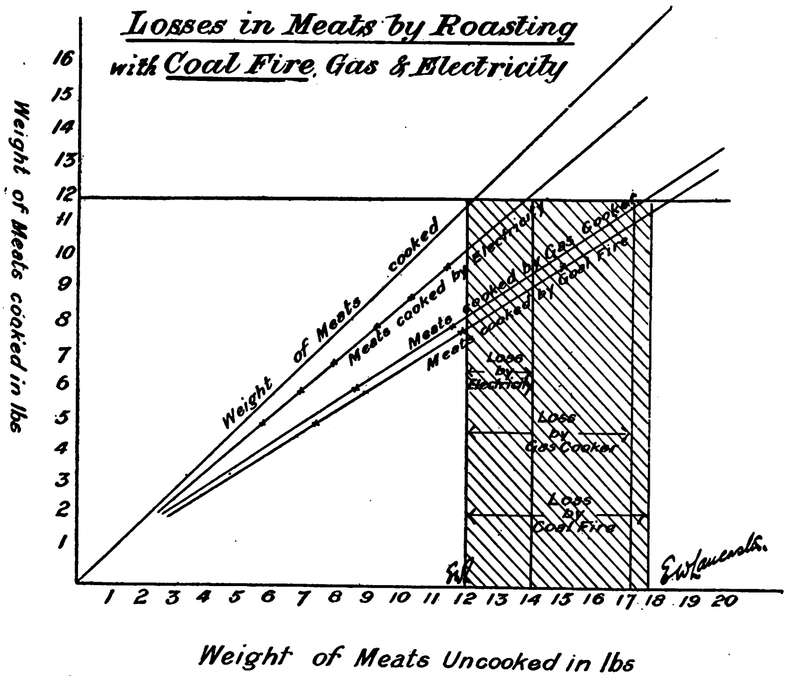
purpose by placing them in a " slow " oven until they become a pale brown. They should then be crushed with a rolling-pin, and passed through a very fine sieve. The following method should be followed when preparing a sole, fillet of plaice, cod steak, or other piece of fish for frittering:—Thoroughly dry the fish, sprinkle flour over the centre of a cloth, put the fish in same; gather the four corners of cloth in your hand and well shake. Then with a small hair brush paint the fish over with the yolk of an egg, dip the painted fish while wet in bread-crumbs. It is then ready to immerse in the hot fat in the *frittering pan.* The hot fat will cook the fish in a few minutes without soaking into it, as owing to its yolk of egg, and to the moisture in the fish being converted into steam by an intense heat, the fat cannot possibly enter. As soon as the coating has become a nice pale brown and the bubbles have ceased, the fish is done and should be immediately taken out with a drainer or draining basket, allowing all the fat to drain off. The fish then should be placed on a piece of blotting paper, and finally on to the hot plate or dish, provided with a white drying paper and served to table.

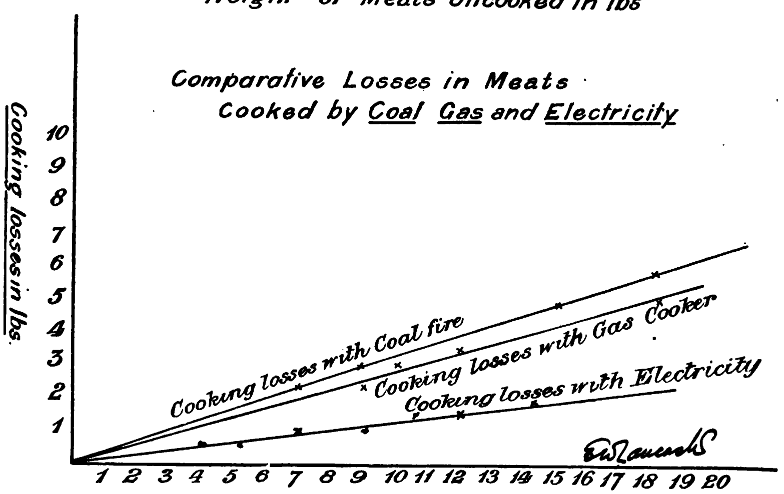
MEAT LOSSES

In Cooking by coal or gas it has hitherto been the practice for meat to lose from a quarter to a third of its weight. This is given on the authority of Mrs. Beeton and others. The losses according to Dr. Lethely Wm. Pavey are as follows:

	Percentage of Loss.		
	Boiling.	Baking.	Roasting.
Beef	20	29	31
Mutton	20	31	35
Leg of Mutton	20	32	33
Shoulder of Mutton	24	32	34
Loin of Mutton	30	33	36
Neck	25	32	34
Average	23%	31%	34%

The following diagrams give comparative losses in roasting meats:





Losses Due to the Manner of Applying the Heat.

COMPARATIVE LOSSES IN MEATS COOKED WITH COAL, GAS AND ELECTRICITY

The losses plotted on these two diagrams are from the results of tests during the ordinary methods of Cooking with coal, gas and electricity; higher efficiency results for Electric cooking than shown have been obtained, the losses recorded being in several cases 8 per cent only, but greater care has been taken in carrying out these tests than is usually exercised in ordinary cooking.

It is, of course, understood that this higher efficiency in cooking of meats is obtainable *more* from the fact that the meat is cooked slowly in its own juice, and in a uniform temperature, without the juices being carried off, as they are with the present coal and gas cooker, than from the class of fuel supplying the heat. I have already pointed out that Count Rumford, over 100 years ago, obtained almost the same high efficiencies with a specially constructed coal fire cooker, but the expensive construction prevented its commercial adoption, although it was the pioneer of the coal fire range.

The paper bag cookery, enclosed "roasters," paper-lined baskets, and the heat storage cookers lately brought into use has proved what can be done in getting equally high efficiency with *coal, gas and other means*, by uniform heat with extra care, but it was electric cooking which first brought to light the deficiencies of the ordinary coal and gas methods, and it is the easy and sure means of application by which this high efficiency can be obtained, also the definite knowledge of results, which make electric cooking in advance of all other methods, and in the same degree that Electric light is in advance of all other methods of artificial lighting for the home.

When using an electric oven, the housewife or cook knows for certain that a movement of one or more switches will once and always produce a certain temperature, and so long as these

switches are in a given position, so long will that temperature be maintained. With gas or coal cooking, there can be no such sure and certain knowledge. It is difficult to adjust the gas taps twice alike, and even if this could be done, the gas pressure may change at any moment, or the internal oven temperature be affected by draughts or by several other causes. So far as coal is concerned, the cook is at the mercy of the fire to a great extent, since the oven cannot respond quickly to changes in the control of dampers and to poking of the fire or addition of fuel. The coal oven is always an uncertain quantity. One day it will cook satisfactorily, the next it will be too fierce, while on a third occasion it will be too slow. There is no nonsense of this kind with the electric oven, which is always alike, always ready, and never fails to do its work with economy, cleanliness and freedom from supervision.

TYPES OF HEATING ELEMENTS

Heating Element. This is the name given to that portion of a cooker or heater which gives out the heat for warming an oven or hot plate or raising the temperature of a room. It consists of some material which is more or less a bad conductor of electricity, and when current is taken through it by making it form a portion of an electrical circuit, it becomes hot owing to the resistance it sets up to the wave or flow of current. The greater the resistance, the more intense the heat, but great heat can be set up by employing an element of lower resistance and using more of it. If a wire is used as the heating unit, the thinner it is, the greater is its resistance, but much depends upon the kind of wire and its length. For cookers running at a high temperature, such as is needed in ovens and grills, a thin wire of special nickel alloy is usually employed, this being proof against oxidisation; against the action of acids in fruit, and vapours produced during the cooking process; and against breakdown through frequent and violent changes of temperature. The wire may be laid over strips of mica in the form of a close winding, mica being an excellent insulator, capable of withstanding great heat; it may be in the form of a spiral threaded through tubes of quartz glass, the latter acting both as an insulator and as a support for the wires, this kind of glass being proof against cracking by the application of water or grease even when red hot; or it may be wound in the form of a flat helix, with mica separating adjacent turns; a sheet of mica or of quartz being used on one or both sides. In other cases the wire is exposed, and wound in long lengths over insulating supports, or in coils supported by porcelain insulators fixed in the cooker frame. Both the length and diameter of the wire are adjusted for the supply pressure (voltage) with which the apparatus is intended to work, so as to allow the

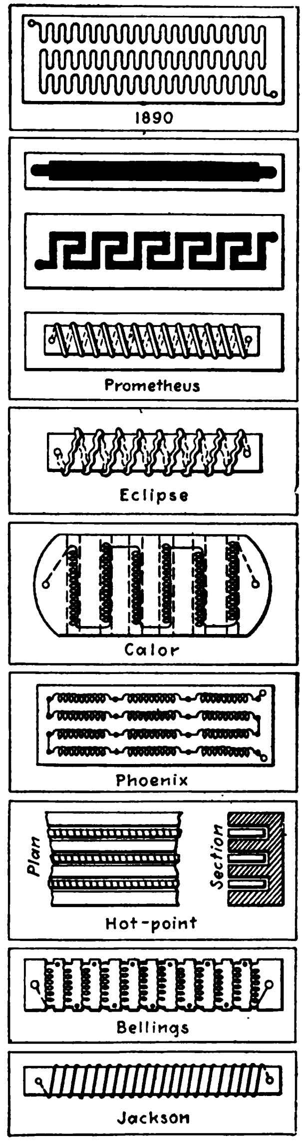
Radiator Lamp

required amount of current to pass which will give the requisite temperature for the work in hand. By this means, a heating element can be so adjusted that it will only reach a temperature sufficient to boil water or heat plates, while another element of the same nature but of different length and size, will reach a temperature of 500° or 600° F., and may even glow at a bright red. It is not necessary to use a wire for a heating element, alternatives being an extremely thin deposit on a mica base, of an alloy of copper, gold and other metals having " royal " characteristics, i.e., those which do not rust or oxidise by exposure to moisture or at high temperatures; or blocks of metalliferous earth, a material which has lately been introduced and for which great advantages are claimed. It is possible, in certain circumstances, to generate very considerable heat by the influence of an electrical current passing through a coil of wire laid over strips of copper in conjunction with a core formed of thin plates of iron, but this system, while quite practicable for cookers, has been abandoned commercially, because it can only be adopted on alternating current circuits. A heating element may be formed from any material which offers a resistance to the passage of current, but its value for practical purposes depends upon many conditions, which have been found by prolonged experiment to be met most thoroughly by a wire of special nickel alloy. Granules of carbon have been tried and are used for one type of water heater on the market, the loose contact between the particles setting up sparking when current is passed through them, or at least becoming heated owing to the increased resistance at the points of partial contact. In another water-heating system, the resistance of the water itself is employed to heat it, the water being allowed to flow through perforated platinum plates connected to the supply cables. As soon as the water touches any two plates, it completes the electrical circuit, but does not allow of a ready flow of current owing to its high resistance, and it thus becomes heated. The heat from radiator lamps has also been applied to cooking, but this system has many disadvantages in practice, and is not likely to be adopted on any large scale. In one system of recent introduction, the resistance wires are immersed in oil, which acts not only as an excellent insulator,

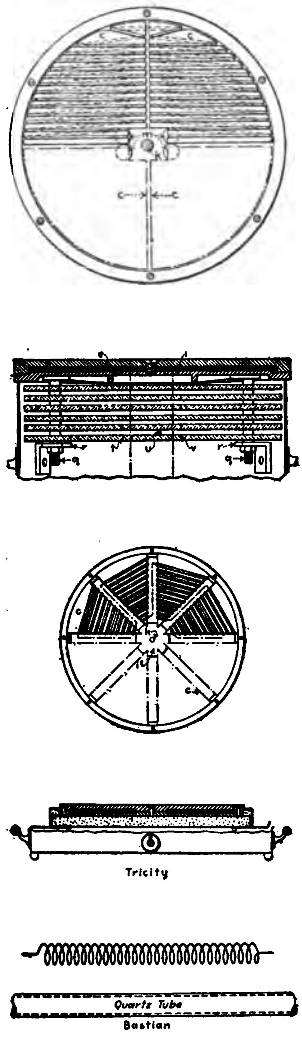
but by its circulation through the sealed chamber in which the element is contained, produces a very even heating effect over the whole cooking surface of the apparatus. In other systems, such as one of the forms employed in the "Prometheus" elements, the resistance wires are coated with a special oxide which, while protecting the wire, attains a much higher temperature than the wire itself and so enables the element to be run at a greater heat without strain or risk than is possible without the coating.

The early electric heating elements were made up in spiral form of iron, German silver, and other resistance wires and were similar in form to resistances used for motor and lamp regulation. For self-contained utensils fine German silver wire was embedded in enamel in the form shown in the sketch. For cigar lighters and other very small heaters, German silver wire was threaded in thin mica.

The Prometheus Company introduced three forms of elements, first their strip element, consisting of a deposit of gold and platinum on strips of mica, then their ribbon element in the key pattern form used for flat irons, hot-plates, etc.; then oven elements took the form of special high resistance wire or tape wound over mica, varnished and encased with thin steel. Sketches of the three forms are shown.



Rough Sketch of Elements.



Rough Sketch of Elements.

The "Eclipse" Element consists of high resistance ribbon crimped to give greater length and free-air space, wound over mica strips with the ends connected to heavy eyelet terminals as in rough sketch.

The " Calor " Element has a base of fireclay with grooves into which spirals of fine high resistance wire are placed.

The "Phoenix" Element has spiral wire coils held lightly at short intervals by porcelain insulators mounted on a suitable base.

The " Hot-point " Element is made up of nichrome wire or ribbon, wound lightly around thin strips of mica, then further covered with a thin mica covering and inserted very tightly into grooves or slots made in the hot-plate or iron base to receive the finished strips.

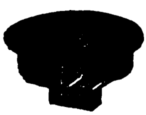
The " Belling " Element consists of a fireclay strip with spirals of nichrome wire stretched across the width of the base, notches being provided in the base for receiving the ends of the spiral and holding them tightly in position in the manner shown.

The "Jackson" Element has a different class of fireclay base with quite a smooth surface, the section of the strips, being a flat oval, wire or ribbon of nichrome, is wound tightly over the strip in one continuous length and clamped between heavy terminals at each end.

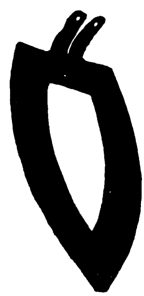
The " Tricity " Elements are shown

in pian and section of two forms. They consist of nichrome ribbon wound over thin mica in the manner indicated on sketch and clamped between thin sheets of mica and metal. The method of winding provides for uniform distribution of heat at any loading.

The Bastian or Quartzalite Element consists of a spiral of nichrome wire or ribbon ccated with a film of *oxide* insulation. The spiral is held *in* or *on* a tube of quartz. The turns of the spiral may be close together without fear of short circuit. This gives it a " hot-rod " appearance.



General Electric Company of America. Cartridge elements are used in the cast-iron disc stoves, grids, broilers, etc. For 110-volt circuits German silver is used, and for 220-volt circuits calorite is used. The element is one and one-fourth inches in diameter by five inches long; resembles a cartridge, and is usually inserted in a close-fitting chamber bored into a casting. It is a thin tape of resistor (about one-eighth inch wide) coiled to form a hollow cylinder. Between the turns is an insulating cement, which binds the whole into a solid tube. This cylinder of wound calorite is inserted in a mica-lined metal cartridge shell which in turn is inserted into the bore of the appliance.



The encased disc heating elements are used in small water heaters, chafing dishes, coffee percolators, teakettles and small disc stoves.

The " resistor " is made of calorite ribbon wound around a thin disc of mica. (It is sometimes made in the form of a grid, punched out of paper-thin sheet.) It is encased and clamped between thin metal plates, and separated from them by mica. These thin sheets of mica are capable of resisting 1,000 volts, but they offer no hindrance to the free passage of the heat to the casing. The encased " resistor " is mounted on a heat-insulating compound, in which the

connections are imbedded and by which the terminals, are supported.

The leaf elements are made of calorite in shapes other than discs. They are used in the flatiron. The upper and lower cast-iron plates of the iron are bolted tightly together with the element clamped between and insulated from them by mica sheets.

Spiral Coil Element. Spiral coil elements are usually applied to heating flat surfaces larger than six inches in diameter. In the water heaters, the "resistor," is an open helical coil laid spirally in a pan, each turn of the spiral being separated by a continuous strip of mica. The heating surface is electrically insulated from it by a layer of mica or other insulating compound designed to withstand high temperatures.

When these "resistors" are used in grids and ovens the coils are arranged in parallel. There is sufficient air space between adjacent coils to insure insulation in this type.

The "Ferranti" Element is made up of nichrome wire coiled in disc form with thin insulating material between adjoining turns. Throughout its length an insulating disc covers top and bottom and the whole is tightly enclosed in a sheathing of metal. The illustrations show the manner of making up the disc and their alternate appearance in two-heat, three-heat, and grill or broiler oval form.






"Ferranti Elements."

Dowsing's "Hot-Bar" Element is a fireclay base with longitudinal grooves into which are tightly pressed long spirals of nichrome wire, which when heated has the appearance of a "hot-bar."

Dowsing's "Hot-Bar" Element.

The Carron Company's latest Form of Grill Element, with a Double Element Grill.

ELECTRIC COOKING IN SCHOOLS

As Electricity is making such progress in domestic duties, our schools ought to be equipped with the latest apparatus. The London County Council, and other Educational Authorities, in England and America, have already fitted up their establishments so that the pupils who are to be the housewives, helps or domestics of the future, may become fully educated in the proper and best methods of cooking, and other domestic uses. I am able to give examples of the kitchens fitted in Miami University, Oxford, Ohio, and the St. Cyprian School, Eastbourne. These are not the largest, others having very much larger equipments, but they are representative of what is being done.

School Kitchen. Electricity has displaced coal for cooking at the large kitchen attached to St. Cyprian's School, Eastbourne, and the equipment is shewn in the accompanying photograph. It consists entirely of "Tricity" apparatus, and has been supplying meals to a household of 100 daily since August, 1912. Current is taken from the Corporation mains and used at a pressure of 100 volts. The average consumption is 332 kelvins, or units, per week, and this works out at .48 kelvin per person per day—less than ½d. or 1 cent per person for cooking all the meals during the day.

The kitchen range has not been lighted since August, 1912, the reliability of the electrical apparatus rendering this unnecessary. Owing to the lessened work in the kitchen it has been found possible to reduce the staff by one member.

The cooking outfit consists of four "Tricity" ovens, each measuring 19″ by 14″ by 16″, heated by 800-watt plates beneath and 800-watt extension rings on top. There are four single cookers with 2-gallon urns for tea and coffee making, two Duplex and two single cookers for grilling, toasting, and boiling vegetables.

Kitchen of the St. Cyprian's School, Eastbourne.

Above the ovens is the large plate-rack which formerly stood over the kitchen range, and above this is a canopy supported by a counterweight, the space between being used for plate-warming and so forth.

A coke-fired boiler supplies water at a temperature of 150° for washing up and other purposes, also for the electric tea and coffee urns where the temperature is raised from 150° to 212°. The boiler is used for burning up a considerable amount of refuse.

Twenty-one Hughes Hot Plates, in the Domestic Science Room, Macauley School, Edmonton, Alta.

Twelve Hughes Hot Plates and No. 60 Range, in the Domestic Science Room, Miami University, Oxford, Ohio.

Cookery Students using "Tricity" Apparatus.

Cooking with Electric Chafing Dish.

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ELECTRIC COOKERY AT THE TABLE

Examples of Small Portable Apparatus for Use at the Table. They are a great boon for light work. These appliances can be obtained from the Electric Contractors, Electric Supply Works, the Chief Stores, etc. It is necessary, when ordering, to tell the name of the supply Company, or the *voltage* at which the Electricity is supplied at the place where the appliances are to be used.

My first illustration shows a handy cooker in use on the breakfast table. This useful device is made by the Simplex Heating Company, of America. It is a completely equipped kitchen for your table. The smallest, most attractive and efficient cooking utensil you can imagine—a stove, a kettle and a stew pan, and the whole of it measuring but five inches by ten, with a detachable cord connection for the usual lamp socket.

The stove, mounted on a marbleised base which has rubber-tipped feet, is equipped with a three-heat switch, permitting economy in operation.

The kettle and stewpan, each holding a pint and a half, are made of nickeled copper, with ebonised wood handles. The pans have grooved bases to fit on the stove. This not only ensures that all the heat is usefully employed for cooking, but prevents any accidental overturning of the utensils.

You can prepare a whole meal if you like on the table cooker. In fact, you can do anything but bake or roast with it.

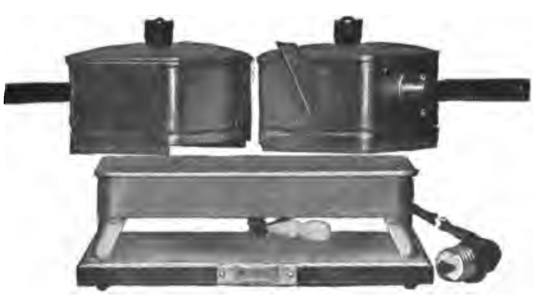
For breakfast it permits you to serve two or three people in the most dainty and appetising manner. While coffee or some other hot drink is preparing in the kettle, your porridge or eggs or saute potatoes may be cooked in the stewpan. After this, you may remove the pan, keeping your coffee on the stove and add a little water perhaps for an additional cup, and on the other end brown a few slices of the delicious toast that is peculiar to electric cooking. If you require them, chops may be broiled quickly on the stove or it may be used for griddle cakes or bacon. With the use of a muffin-ring the stove may be further utilised for muffins, fried eggs, fish cakes, etc. The variety of breakfast dainties you have at your immediate command is surprizingly large.

The table cooker is a kind of kitchenette, that you may literally carry with you where your mood dictates, from the breakfast-room to the drawing-room for afternoon tea, into the garden, or wherever your ingenuity may suggest a use, and your electrician a lamp socket.

For entertaining in a novel and attractive manner, there is nothing that could be thought of that will meet so successfully the requirements of so many occasions.

The table cooker is most convenient for getting up an impromptu snack after the theatre and there is no more appealing way of tempting the convalescent than by electrically prepared dishes.

For the invalid, indeed, a cup of broth or a glass of hot milk may be so readily obtained, and served so hot and temptingly that some such apparatus as the table cooker really becomes essential to the nurse.



Breakfast Cooker by the Simplex Co. of America.

As for the cost of operating the table cooker at the outside it is about 1½d. or 3 cents a meal.

The B. T.-H. Radiant Grill. Another style of breakfast cooker has been introduced by the General Electric Company, of America, and by the British Thomson-Houston Company, of Rugby, England. It is called a radiant grill and toaster, and is a compact nickeled table stove, especially suitable for the breakfast table or nursery. With a minimum amount of attention it may be used to grill, broil, toast, stew or fry. The cost of operation is about .6d. per hour or just over 1 cent.

The heating element is contained in the upper portion of the stove, which is attached to the stand by a divisible hinge. This portion can be lifted (as shown in the illustration) to allow the bacon, steak, or whatever is being cooked, to be placed underneath on the grid or rack.

The heating unit consists of a spiral coil of calorite metal supported by heat-resisting insulators and protected by a neat nickel-plated screen made from expanded metal. Calorite metal melts at about 2,800° F., so that the heating element is thermally indestructible under normal conditions.

"Heetorboil" Food Warmer. This is a useful form of table cooker made by Townshend's Art Metal Company, of Birmingham, England. All Townshend apparatus is fitted with "Calor" heating elements, in which the resistance is mounted in various ways, which quickly attains red heat. It will be seen that a divided sliding top is fitted, which uncovers the boiling plate, and thus gives additional useful surface. At full heat, boiling can go on in the middle and warming at each end, to say nothing of the rack below. A lower heat is also available. The length is 21½ ins. extended and 15 ins. closed, and the height is 5¼ ins. Made both in polished copper and brass and in polished aluminium, it is attractive in appearance. The handles and feet are non-conductors. The cost of operation at full heat is less than ½d. per hour, or 1 cent, the current consumption being 440 watts at high and 200 watts at low heat.

"Just-for-Two" Table Cooker. To meet the demand for small cookers, which may be used on the breakfast or supper table to prepare simple dishes, the manufacturers have designed several patterns which suit the varying requirements of users. The smallest cooker is known as the "Just-for-Two," since its capacity is equal to the needs of two persons at breakfast. It will boil, fry, or toast, the cooking process

Townshend's "Heeterboil" Food-warmer.

going on above and below the heating element. Four pieces of toast can be made simultaneously, but if all the heat is required on one side a polished deflecting plate is supplied, which can be slid into grooves above or below the heating unit as may be required. A deep pan is provided for frying and grilling. The wire elements run at a bright red heat, and are protected by a grid. They are rated at 600 watts, so that the cost of operation is .6d. per hour, or just over 1 cent.

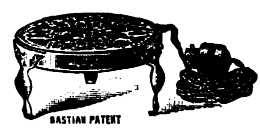
"Just-for-Two" Cooker.

Combination Breakfast Set. The compact outfit illustrated comprises a hot plate for a $1\frac{1}{2}$-pt. square kettle, and a $1\frac{1}{2}$-pt. square saucepan, mounted on a light marbleised base, all the metal parts being nickel-plated. For use in the saucepan, a wire holder for four eggs is supplied, but, of course, the vessel can be used for many other purposes beyond egg boiling. The utensils, which have ebonised wood handles, slide over the hot plate, and cannot accidentally be knocked off, while the arrangement ensures close contact between the hot plate and

vessels to be heated. One and a half pints of water can be boiled in just over 15 mins., the heating elements being rated at 550 watts, and thus costing just over $\frac{1}{2}$d. an hour to use, or slightly more than 1 cent. The combination makes a neat and serviceable outfit of attractive appearance, which is offered at a reasonable price.

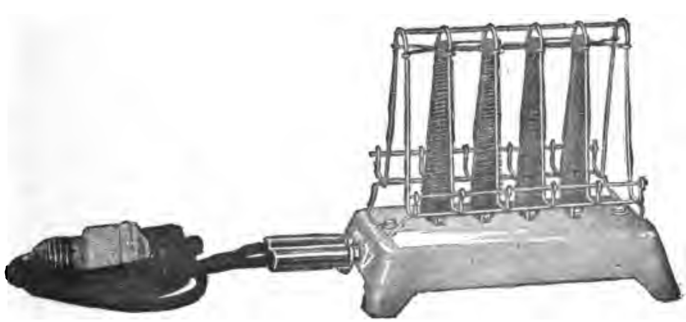
In the illustration will be seen a breakfast table equipped. The outfit comprises a kettle, coffee percolator, toaster, egg boiler, chafing dish and grill of bacon.

"Pygmy" Heater. This convenient and cheap table heater will keep your kettle boiling, fry your bacon on the breakfast table, boil your eggs, cook your griddle cakes, keep your toast and tea cakes hot, roast your chestnuts, light your cigarettes, or warm your shaving water. It uses only about a unit in 8 hours, and may be used for an hour every day for a week for less than 1d. or 2 cents. It is supplied by the Bastian Electric Heating Syndicate, of London, the Edison and Swan United Electric Light Company, Drake & Gorham, Ltd. and agents throughout the world.



"Pigmy" Heater.

Toasters. Toast served smoking hot on the table is a different thing from that brought in hard and half cold from the kitchen. With an electric toaster, delightful, crisp toast, delicately browned and evenly toasted all over, with no suspicion of burning, can be prepared on the breakfast or tea table or by the bedside, in a few


General Electric Co.'s Toaster.

moments. The toaster can be connected to any source of supply, and consumes less than half a unit an hour, costing ½d. or 1 cent, but the apparatus is only needed for a few minutes at a time. Starting from cold, two pieces of toast can be prepared in two minutes, both sides being toasted evenly. There is no comparison between toast made electrically and that made under a gas grill, the former is just ideal, the latter absorbs the flavour of the gas, may be burnt in one part and not toasted at all in another, dried up or sumpy according to the conditions met with at the moment. With the electric toaster, the results are always alike, and always satisfactory. I show one or two typical designs of English and American toasters. In the latest design of the "Magnet" Toaster the "elements" and connections are protected by a steel shield which prevents any possibility of the operator touching any part of an exposed circuit.

Siemen's Toaster.

"Prometheus" Toaster.

"Hot Point" Toaster.

"Universal" Toaster.

"Magnet" Toaster.

Coffee Percolator.

" Universal " Coffee-pot.

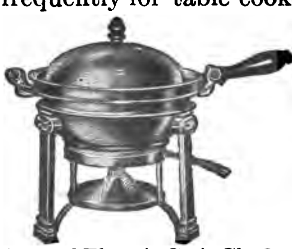
Coffee Percolators. It would be difficult to over-estimate the difference between coffee prepared in the ordinary way and when made in an electric percolator. In the former case the coffee is usually a dark fluid with grounds at the bottom and never twice alike in flavour, colour or perfume; in the latter case it is a delightful beverage, clear in colour, absolutely free from deposit or grounds, always alike in strength and flavour, and possessing a delightful aroma. It is possible to use a cheaper grade of coffee and to get results equal to that of the more expensive berries when prepared in the old way, while the coffee goes much farther. A percolator is quick, simple to operate, pretty in action, free from smell and dirt, and is ready for use at a moment's notice. The example I illustrate shows the General Electric Company's American design. Will prepare 5 to 8 small after-dinner cups, or 2 large breakfast cups; the larger pattern holds sufficient for at least 12 small cups. Starting with the water

cold, black coffee is ready to serve in 8 minutes with the small machine, and in about 12 minutes with the larger style. After making coffee, the top of the small percolator may be removed, and the cup used for boiling eggs. The cost of operation is less than ½d. or 1 cent per hour.

Tea Samovar. A companion to the coffee percolator is the Electric Tea Samovar, which gives the same result as the original Russian Samovar without any of its inconveniences; you merely switch on the current and in a few minutes delicious tea will be ready to serve, the strength of which can be varied to suit the taste. The size illustrated has a capacity of 6 cups and uses so little current that it is hardly possible to state exactly the cost of making sufficient for 6 cups.

A neat form of electrically heated *Coffee-pot* made by the Universal Electric Company is here illustrated.

The Electric Chafing Dish. This is a delightful accessory appreciated fully in America, but little known in England. By its aid many dainty dishes may be prepared on the table in a few minutes. When returning from the theatre at night, a welcome little supper can be served piping hot with no previous preparation. Omelettes, eggs in various forms, cutlets and many other dishes can be prepared with the chafing dish, and when a lady has once had experience of its capacity, it will be used frequently for table cookery.



General Electric Co.'s Chafing Dish.

"Universal" Electric Chafing Dish.

B. T. H. Tea Kettle.

Electric Kettles and Self-contained Portable Water-heaters. One of the most useful accessories for domestic application is the electric kettle. This is suitable for drawing-room, dining-room or bedroom use, and can be connected to any source of supply by means of a flexible cord. Water can quickly be boiled, and there is no risk of fire, no danger of scorching or damaging polished tables or their coverings, and no smell or dirt. For the early morning cup of tea, or afternoon tea in the drawing-room, they are ideal, and are so simple to use that a child can handle and control them. In most cases the heating element, formed of a fine resistance wire wound over mica strips, is placed in a false bottom to the kettle, but in some designs projecting pockets inside contain the heating unit, so that the water surrounds them completely except at their bottom edge. This construction gives a slightly higher efficiency than when the element is placed flat under the inner lining of the kettle. There are kettles also in which the heating element is in the form of a band placed round the outside, with an external covering of polished copper. In still another form, the heating unit is in the form of a small cylinder attached to the lid, this being immersed bodily in the water. Although its efficiency is very high, this arrangement has certain disadvantages in practice, one of these being that the flexible cord may touch the hot sides of the kettle or may be wetted by steam or water, which would damage the insulation and might

"Simplex" Kettle.

"Simplex" Kettle.

A "Simplex" Kettle.

cause a short-circuit. Whatever the details of construction may be, all electric kettles are alike in having a high thermal efficiency, and most are arranged so that it is a simple and inexpensive matter to fit new heating elements, should the original ones give up in course of time. Replaceable elements are convenient also, if a user should remove from one district to another and the voltage or pressure of his supply at the new home should differ from that at the old address. Thus, if he has been using a kettle or other device on a 200-volt supply, and should remove to a district supplied at 100 volts, it is a simple matter to get new elements constructed for 100 volts, the old 200-volt elements being put on one side in readiness for use should a second removal be contemplated. It must, of course, be understood that an element intended for 100 volts is useless and must not be connected to a 200-volt supply, and *vice versa*, and it is important that before any apparatus is used, care should be taken to ensure that the elements are suitable. This can easily be done by examining the bottom of the device, which will be marked something like this—200/210 V. 2.4 A. This means that the kettle may be used on 200, 205 or 210 volts, but at no other pressure, and that it takes 2.4 amperes of current. From these figures, by multiplying them together, the wattage or energy consumption of the kettle can be ascertained. For the kettle in question, the watts would be 480, a little less than half a unit per hour, since current used at the rate of 500 watts for an hour would absorb half a unit or 500 watt-hrs., a unit being 1,000 watt-hrs.

A Dowsing Kettle.

Electric kettles are made in many patterns, in tin, copper, nickel-plate, brass and aluminium, and with feet for use on the table or supports for hanging on a table or floor standard. The energy consumption varies also

according to the size, but for an ordinary afternoon tea kettle is usually about 500 watts. A 2-pint kettle at this loading will boil in less than 12 minutes. Most kettles are arranged for heat regulation, and by the use of an ingenious connecting piece or by changing the position of 3 loose connectors on the contact pins projecting from the side of the kettle, 3 or 4 heats can be secured. This is convenient, for the full heat will bring the contents quickly to the boil, while the water can be kept at boiling point at quarter heat. The intermediate heat is useful when boiling water is not needed quickly, the time taken to bring an equal quantity of water to boiling point being about double that taken with full heat.

In selecting a kettle choose one, if for table use, which is mounted on heat-insulating knobs or feet, so that the heat is not transmitted from the kettle to the table cover. See also that the lid is perforated with a small hole to let out the steam, otherwise the water will spill over and do damage. Electric kettles can be bought for as low a price as 7/6 or 2 dollars, but it is better to give a somewhat higher price in order to get a more trustworthy article, and one which will stand prolonged use. Do not ever buy a tin kettle, although it may be cheap, for it will rust through long before the heating element is worn out, and as soon as it leaks a tin kettle is practically worthless. A copper kettle to hold 2 pints, if of plain design, can be bought for 12/6—3 dollars. The cheaper grades of kettle usually have only a single heat, and care must be exercised to see that they are switched off as soon as the water boils, in order to avoid damage from boiling water spilling over. In any electric kettle, however cheap, the element ought to be replaceable; it is unwise to purchase one which has not this desirable feature.

I show a selection of kettle designs made by Messrs. Simplex Conduits, of London, but these are only a few out of the many which this and other firms offer. It will be acknowledged that even the plainest pattern is artistic in appearance, while with care it will last and give good service for many years. I can show in use to-day a copper kettle bought just ten years ago from the British Prometheus Company of Birmingham, England, and although it is a trifle battered, it works just as well as

Breakfast in the Electric Home.

Electric Earthenware Jug of
Baxter & Caunter, London.

" Simplex " Milk Boiler.

the day it was bought, and it seems likely to go on working for many years yet. Many excellent examples are supplied by the General Electric Co. of America.

Electric Water Jugs and Milk Boilers. Of great utility are electric water jugs. For use in the morning for washing or shaving the water can be kept hot till required, or on the table they are convenient in place of a kettle or urn for filling up the tea-pot, some in earthenware as illustrated. For cocoa-making, or milk boiling, special jugs are supplied, and these are far superior to plain vessels. In the case of the milk boiler, the annoyance of the milk boiling over is obviated, for the special perforated lid entirely prevents such a calamity, even if the current be kept on after the milk has boiled. Larger water heaters are made for use when a party of thirsty souls want tea and the kettle is not large enough for the purpose. These are usually of copper and may be placed safely on the table, but take heavier currents

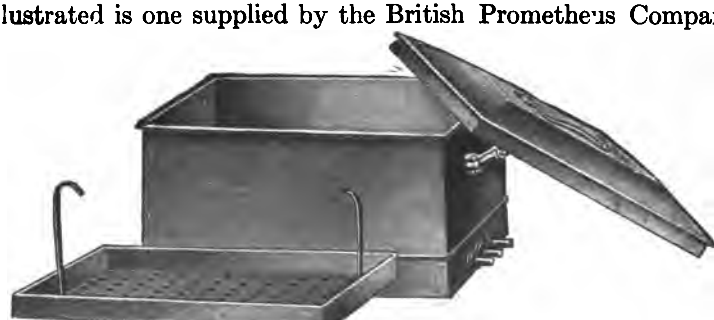
"Magnet" Milk Boiler.

than a kettle and need larger connecting wires. They should therefore be conected to a wall socket, and not to the nearest lamp-holder, as is permissible in the case of smaller vessels or toasters.

"Magnet" Tea and Coffee Urn.

A "Prometheus" Urn.

Electric Milk Sterilisers. The importance of sterilising milk before it is used for drinking cannot be too strongly urged. Milk as delivered, even from the best dairy, may be infected with all sorts of germs which may cause consumption and other diseases. All risk is obviated if the milk be sterilised before use, and no more simple or satisfactory means can be imagined than an electric steriliser. The example illustrated is one supplied by the British Prometheus Company.



" Eclipse " Cast-iron Saucepan.

ELECTRIC OVENS AND KITCHEN COOKERS

Turning now to larger cooking apparatus suitable for kitchen use. Many designs cannot be referred to at all for lack of space, and the makers mentioned do not include anything like all who are engaged in the manufacture. The samples illustrated are typical of present-day designs, representative both of English and

" Eclipse " Electric Frypan.

" Eclipse " Stewpan for Jam and Preserve Making.

American practice, and although they do not claim to represent finality, they are in every way practicable, efficient and economical in use, and are made in many styles to suit every likely requirement for domestic and restaurant service.

Self-contained Portable Appliances. Saucepans, stewpans, frying pans, grills and other useful articles in great variety with the heating element in the base, are available for kitchen use, some of the liquid heaters

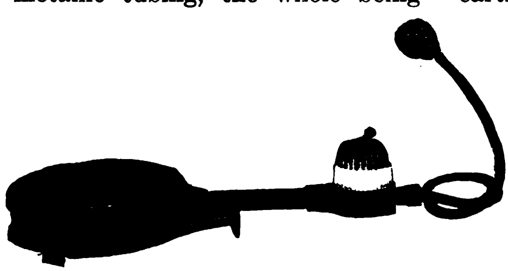
Frittering Pan.

The "Eadisk" Boiling Disc.

holding as much as 5 gallons, and they may be more advantageously used for any purpose for which an ordinary article is adapted. The stewpans and boiling pans are suitable for jam-making or for preparing soups and stews in large quantity.

Hot Plates or Boiling Discs. Many patterns of portable electric boiling discs have been introduced, having the great advantages of cleanliness, reliability, uniform nature or results and absence of danger. The cost of working averages less than 1d. or 2 cents per hour. A very successful type is the "Eadisk" cooker illustrated herewith. It consists of a circular cast-iron plate with heating elements beneath. Three degrees of heat can be obtained, the full heat taking 900 watts. The lower heats take respectively 600 and 300 watts. For rapid boiling, full heat is used; for slow boiling and for simmering, medium or low heat suffices. The switches and also the terminals from which the flexible cord is taken, are protected by a metal housing to guard against damage from spilled liquids. It can be used with ordinary vessels with flat bottoms.

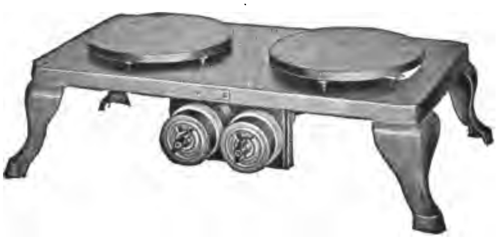
Another useful boiling disc is the "Tricity," consisting of a 7″ plate with extension arm upon which is mounted a switch to give two degrees of heat, high and low, taking respectively 850 and 212 watts. The "Tricity" plate stands on a detachable base, and is connected to a wall socket by a wire enclosed in flexible metallic tubing, the whole being "earthed." The



"Tricity" Extension Boiling Disc.

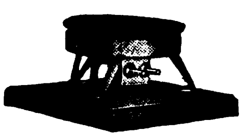
heating surface is ground perfectly flat and may be used with any ordinary utensil provided the latter has a flat bottom to make close contact.

The "Ferranti" boiling plate (p. 123) consists of a rectangular cast-iron pedestal, with polished top, having a standard 7″ detachable heating unit let in flush with the surface. There are two switches mounted flush in the base, permitting of full heat (850 watts) or low heat (300 watts). The large size of the top plate allows of several flat-bottomed vessels to be heated simultaneously, or of one or more being placed over the disc or to one side in order to regulate the speed at which cooking proceeds. Provision is made for " earthing " the device, and the switches and connections are protected against risk of damage from water or grease.



G. E. Co.'s Twin-disc Hot Plate.

The General Electric Co. of America and the B. T. H. of England make very efficient boiling discs of various sizes similar to those illustrated. Practically all the makers of Electric Cooking Apparatus make boiling discs differing very little from the designs shown; almost all run at a dull red heat when full on.



G. E. Co.'s Four-inch Boiling Disc. G. E. Co.'s Six-inch Boiling Disc.

"PLEXSIM" COMBINATION OUTFIT

This convenient outfit, made by Simplex Conduits, Ltd., of London, is simple in its operation, and can be placed in any convenient position on a table whilst in use, and when not required can be moved out of the way. In premises where room is a consideration, especially in flats, this point is most important. The outfit primarily consists of a boiling plate made in cast iron. For use with this hot plate three utensils are designed, which fit closely to the surface of the hot disc, thereby minimising any loss of heat and ensuring the greatest efficiency in working. The

A Compact Combination Set for Small Households.

first of these is a kettle made in aluminium, the next a saucepan, and thirdly a frypan. These utensils, with the hot plate, form a set which, whilst capable of carrying out a number of culinary operations, in themselves form a very useful addition to a standard electric cooking equipment. A fourth item, which makes the set complete, is an oven. This is constructed of highly polished metal; this polished surface prevents rapid loss of heat through radiation, and is preferable perhaps to the more usual form of overcoming this difficulty, viz., by lagging. In cast ovens, such as are used for gas cooking, this lagging very soon becomes dirty, owing to its absorbing various products of combustion. Lagging therefore requires renewing at frequent intervals, although it is quite practicable with an electric oven so to seal the space occupied by the lagging that no contamination from the juices of cooked foods is possible.

The oven has an aperture in the bottom, into which the hot plate fits so as to form a complete heating unit. The hot plate takes 800 watts, the cost of working being, therefore, less than 1d. per hour or 2 cents.

"Venner" Silver Grill. Quite a departure from the usual type of electrical cooking apparatus are the "Venner" grills, water heater and oven, designed by Mr. R. Venner and made at present by the Venner Signs Co., Cornwall Works, Kennington, S. E. The system consists of fine resistance wire wound over strips of mica immersed in special oil, the heating chamber being hermetically sealed except for the provision of a safety

"Venner" Grill for Household Purposes.

“ Plexsim ” Oven, Lid Closed.

vent to guard against undue expansion. The use of oil has several distinct advantages. It is not only an excellent insulator, but its circulation, effected by the warmth from the heating elements, ensures an even and thorough distribution of the heat, so that the entire working surface is at a uniform temperature, a very desirable feature for cooking any dish. The Venner grill, of which I give an illustration, is a nickel-plated vessel of oval shape, something like a shallow entrée dish. It is rated at 450 to 500 watts, and costs therefore $\frac{1}{2}$d. or 1 cent per hour when in operation. It will cook chops, steaks, fish, cutlets and any other small dish, very quickly and most perfectly, the temperature of the cooking surface being about 420° F. A 3-lb. piece of steak was cooked with this grill to perfection in $9\frac{1}{2}$ minutes, starting all cold, with a total energy consumption of 71.25 watt hours, less than $\frac{1}{10}$ of a unit. Its remarkable economy is a special feature of the system, which has been applied also to geysers, water heaters and ovens with marked success.

“Plexsim ” Oven, Cover Raised.

"Plexsim" Oven. For small households a large oven is seldom needed, and there is a demand for an electric oven which will cook say a 6-lb. joint when required, and can be used at other times for baking puddings, cakes or light work of a similar nature. To meet this requirement Messrs. Simplex Conduits have introduced the "Plexsim" oven for which they make the following claims:

In many forms of electric ovens the heat losses from radiation and from opening the oven in order to examine the contents waste a large portion of the current used. In the "Plexsim" oven these *heat losses* are avoided, so that the *consumption of current for work done is correspondingly reduced.* Food in process of cooking may be examined as often as desired without fear of loss of heat or delay in cooking. This advantage is secured by an ingenious arrangement whereby the act of opening the door creates a partial vacuum behind the heat-retaining partition into which the heater elements and the heated air are taken. At the same time the heat dissipated by the elements is also sealed in this chamber. Upon closing the oven both elements and hot air are once more in position, and cooking continues immediately. The illustration showing the various parts will explain the action of the device.

A cooking temperature is reached within 5 minutes of switching on the current. A further advantage is that owing to its shape, heat circulation is set up, and *all parts of the Oven* attain an even temperature. The oven is constructed of polished metal, and if kept clean inside and polished outside there will be little loss from radiation. *The hood of the Oven is detachable, so that all parts are readily accessible.*

The elements are of the "red hot" type, and therefore actually roast. They are guaranteed for 12 months and are readily removable, so that in the event of a breakdown or accident, new elements can be easily fitted. The work of taking the Oven to pieces only entails the withdrawal of two pins, whilst it *can be reassembled in a few seconds.*

The Oven is arranged for heat regulation, and is fitted with inside grids, 2 shelves and drip pan. *The temperature regulation is arranged for by means of a neat "one-piece connector."* The element is fitted with the usual three pins, the connector being so arranged

that it is only necessary to shift its position to give reduced heat. At full heat, the current consumption is only 1,200 watts, the running cost being only a trifle more than 1d. or 2 cents per hour, but as the full heat is only required for the initial warming up of the cooker, the actual working cost is considerably less.

"Credenda" Oven. An example of a neat form of Oven, as shown, has been introduced by Credenda Conduits, Ltd., of England. In external appearance it follows the design supplied by the General Electric Company, of America, and several other well-known makers.

The main feature, however, of this oven is its portable nature, since the sides, top and bottom, as well as the legs, can in a few moments be taken apart, the whole apparatus thus packing flat for transport or removal. It is a useful design for flats or small households, its capacity being equal to a 10-lb. joint, with a couple of puddings at the same time. Its framework is of cast iron, with polished mouldings, the sides, top and bottom being of nickel steel sheets, two thicknesses being employed, with the space between packed with heat-insulating material to reduce radiation losses. The outside and interior surface of the oven door are nickel-plated, the door hinging at the bottom and forming a shelf upon which food may be placed after being drawn out of the oven.

"Credenda" Oven, showing grill and boiling discs attached.

The heating elements are of nichrome ribbon wound over mica strips, and encased in steel. They are bolted to a frame in groups of six, arranged so that 3 elements are in series. The frames supporting the elements are attached to the sides of the oven, a clear air space being allowed between the frame and the oven side. This ensures adequate air circulation throughout the interior, giving uniform heat, so essential for good cooking. Cast-iron heating plates in front of the elements protect them from injury, and from causing undue local heating, these plates being used also to carry the grid shelves inside.

A good feature of the oven is that there is no internal wiring, the ends of the resistance ribbon being taken to split-pin terminals projecting through the sides of the oven. Connection is made to these by loose connectors, and armoured flexible wires, the control being effected at a switch and fuse panel on the wall. Each group of six elements is rated at 750 watts, and as there are two such groups, one each side of the oven, the total loading is 1,500 watts, the cost of running at full heat being, therefore, 1½d. or 3 cents per hour. The switch control provides for several lower heats than the maximum, with correspondingly lesser consumption. At full heat, a cooking temperature (400° F.) is reached within 20 minutes from the moment of switching on. The internal measurements of the oven are 14½″×14½″ ×12″.

G. E. C. "Magnet" Light Cooker.

The makers have so designed the apparatus that a grill can be fixed below

and boiling discs hooked on at the sides. These carry their own heating elements, and can, of course, be operated independently. With these additions the device forms a complete cooking outfit suitable for small households.

G. E. C. "Magnet" Cooker. This is constructed of sheet metal, mounted on a rigid framework and finished polished bright. Will roast or bake, fry, grill, stew or toast. Being so compact it can be stowed away when not in use. Ideal for small flats, etc. Suitable for a family of four to six people.

Cooking space	12″×12″×15″
Over all size	14″×14″×22½″
Loading, bottom	800 watts.
Top and grill	1,400 watts.
Total	2,200 watts.

"Berkeley" Automatic Cooker. It is becoming the practice to rely for some part of the cooking upon electric cookers fitted with automatic control, i.e., with an attachment which maintains automatically a constant cooking temperature in the oven and may switch on the current and switch it off again, supplying current when necessary properly to cook the food. Its advantages in small households are obvious, and appeal to every user of cookers, for a meal can be prepared in advance, placed in the cooker and taken out at any desired time afterwards ready for consumption, with the knowledge that the food will have been perfectly cooked and will be smoking hot, yet not overcooked or spoiled by

waiting. Automatic cookers have not yet been taken up to any extent in England, but they have an assured future, and experience of American systems proves that they are reliable in action and give no trouble in practice. One of the best-known and most useful automatic cookers is the Berkeley, of which I give an illustration. It consists of a cylindrical vessel heavily lagged inside with heat-insulating material. It has four cooking compartments which are of aluminium. Meat, cereals, puddings and vegetables can be placed in different compartments and cooked to a nicety, without waste or admixture of flavours. Current may be switched on by hand, or automatically by means of a clock. The automatic feature saves current, saves time and avoids the necessity for watching during the cooking process. The housewife can place the dinner in the cooker before going out for the day, to church or to visit friends, setting the clock to switch on at a certain time. When she reaches home the meal is perfectly cooked ready to serve. There is no possibility of burning, no risk of wastage in the meat, no fear of underdone joints or spoilt vegetables. So thorough is the cooking that cheaper and tougher meats can be used, the joints, when served, being as tender as the most expensive cuts. The makers guarantee the cost of cooking per pound of food not to exceed 100 watt hours per pound of food cooked as well as the materials and workmanship of the cooker itself, which they guarantee over a period of five years. The heating elements are guaranteed indefinitely. At full heat the Berkeley cooker only takes 500 watts or ½ unit per hour, costing ½d. or 1 cent, but the automatic control ensures that as soon as the cooking has been completed the current will be cut off, so that the cost of preparing a dinner is considerably less than would be the case with a cooker controlled by hand, since the personal factor is eliminated altogether.

The "Berkeley" Cookers are made in one size only, with 4 compartments, holding 12 or 14 lbs. of food. Attached to the flexible cord through which current is taken to the cooker, is the automatic time-switch by means of which current can be switched on at any desired time. This is not an essential feature of the Cooker, but may be had as an extra, and is used in conjunction

with the automatic switch inside, the function of which is to maintain the cooking temperature at a constant value all the time that current is allowed to pass.

Dowsing Grill.

Dowsing Cookers and Grills. The Dowsing Radiant Heat Co., Ltd., of London, make various electric cooking appliances, and their Electric Grill and Oven is a very convenient type. The heating elements are made on the same principle as for the Hot Bar Radiators, described on a later page, the heating resistances being covered by a quartz plate, and therefore protected from accidental contact. The elements are easily removable, and the cost of replacing them is only a few pence. Switches are provided giving two regulations. This form of heater is also used in hot cupboards, and can be built up in ovens of any size.

" Lightning " Oven.

" Lightning " Oven. One of the latest electric ovens introduced to the English market is the " Lightning " oven, which was designed by Mr. Napier Prentice, Engineer to the Suffolk Electric Supply Company, and is made by the Armorduct Company, of London.

The oven consists of an outer cir-

cular shell of polished metal, built on an inner shell of sheet metal, so arranged that there is a space between about $1\frac{1}{4}$ inches wide, lagged with heat-insulating material. Inside this double shell, and on an independent frame attached to the inner shell, which is also of circular shape, is wound the heating element, consisting simply of bare high-resistance wire.

The whole of the outer casing, together with the frame carrying the heating elements, is arranged to slide up and down, being carried by three uprights, fitted with pulleys over which supporting wires run to counterweights underneath. These uprights are supported from a base which forms the bottom of the oven. A triangular frame, which carries the adjustable shelves used for holding the food, is also fixed to the base.

When the outer casing is raised, as will be seen in the illustration, these shelves are accessible from every side, and as soon as they are loaded the outer case is pulled down over them, the current switched on, and the cooking process commences.

It will be seen that as there is perfect radial heat distribution around the objects to be cooked, there is no possibility of any localised or unequal heating, the whole interior of the oven reaching an equably high temperature.

There is very little shrinkage of meat during cooking, as there is no possibility of the escape of the moisture-laden air from the oven or of the entrance of cold air from the outside.

The heat control is effected by a switch mounted on the front of the oven, giving three degrees of heat. Just above the switch is placed an indicator lamp, which glows in proportion to the heat being supplied to the element. At the top of the dome a thermometer is provided, so that the temperature of the oven is quickly ascertained.

In the event of the heating element breaking down a new one can be wound over the supports very quickly and at small cost.

The consumption is in the neighbourhood of 1,500 watts, and the cost of running at full heat is, therefore, $1\frac{1}{2}$d. or 3 cents per hour. In spite of this very low consumption, joints of beef up to 26 lbs. weight, in addition to other commodities, can be quickly and perfectly cooked with less shrinkage than is possible

with ovens in which there is a continuous draught of cold air flowing through.

"No-Kaire" Electric Cooker. Somewhat similar in appearance to the "Lightning" oven is the "No-Kaire" American cooker. It has a cylindrical outer casing which can be raised or lowered with the aid of balance weights. In place of a wire heating element wound spirally inside the outer casing, the "No-Kaire" cooker is heated by a circular hot plate at the bottom, the air circulation set up in the cylinder ensuring an even distribution of the heat. It is fitted with a clock time-switch, so that current may be switched on and off automatically at any pre-determined hour. Cooking by electricity is so uniform and always so just alike that it is quite practicable to set the clock for the correct number of minutes necessary to complete the cooking operation in hand, and very little experience will enable users to get perfect results with the automatic switch. It may interest my readers to know how such a cooker is used in practice. Imagine you have a 4-lb. chicken to cook. At 9.00 a.m. it would be placed in the roasting chamber, the current switched on and the clock set to 10.00 a.m. At the latter hour the current will be automatically cut off, but roasting will continue owing to the high temperature of the oven. The chicken is ready for the table at 10.30, but it may be left in the cooker till 1 o'clock without any further attention or consumption of current, and will be hot, ready to serve with the vegetables that have been cooked with it. In preparing a meal of roast beef, carrots and potatoes, the carrots would first be placed in the cooker, as they require a longer time for cooking than potatoes.

"Kelvin" Oven and Hot Plate.

"Kelvin" Cooker with Small Oven and Hot Plates.

They will come to the boil in about 25 minutes. They are then taken out, and a dish containing say 4 lbs. of beef placed on the round disc. The carrots and potatoes are then placed on top of the roasting chamber, with the potatoes over the carrots. The beef would be cooked perfectly in 45 minutes, a further 10 minutes being allowed for every additional pound. Very little water should be used for the vegetables, the cooking process more nearly resembling steaming than boiling. Cakes and pastry can be baked very easily, a cake being baked first, then a pie, the latter needing a greater heat, which is assured when the cooker has been running some time. Stews take about the same time to cook as with a coal range, but less water is needed as there is but little evaporation. No basting is required in the case of meat, and no water should be added, the shrinkage in the joint being extremely small, and the meat itself providing all the necessary moisture.

"Kelvin" Hot Plate and Oven. A novel and probably the most useful design of light cooker for small families provides a long hot plate carrying 5 or more heating elements, some rectangular and some of disc shape, the rectangular shape element arranged to turn up at right angles, permitting the oven to be placed over two of the elements and thus give two side and one bottom heat to the oven. All the elements are provided with two heats, so a quickly heated oven can be obtained at a low expenditure of energy. The ovens are made in two sizes, 13×13×18 high and 20×13×18 high, both fitting on to any size hot plate and being interchangeable. The small oven can be used when pies or pastry, or a small joint only is required, the

larger one being available for larger joints and bread baking. The ovens are air lagged and very efficient. The door has a special panel of toughened glass which will withstand the heat of the oven and allow inspection of cooking without opening the door. Two or more circular boiling plates are available at the side of the oven. When baking or roasting is not required the oven can be stored away, leaving the hot plates only with the elements turned horizontal for use in boiling or stewing. This saves a considerable amount of space and work.

All the elements are interchangeable, spare parts being readily fitted by the householder without trouble.

For grilling purposes a separate attachment is provided to fit on the end of the hot plates.

In another pattern of hot plate, one grill forms the centre portion, the elements acting for grill or oven as required.

There are many novel features including an automatic control appliance.

"Electroyl" Portable Oven. A cheap yet effective oven for small householders is Purcell & Nobb's "Electroyl," shown in the accompanying illustration. It is made in three sizes. It is divided into two separate compartments, one above the other, with the heating element placed between the two. This arrangement of the heat units reduces the loss of heat by conduction to the casing, and ensures an even heat distribution throughout the oven. In the upper and hotter compartment baking, grilling, frying and stewing can be carried out, while the lower portion acts as a hot closet and is suitable for slow cooking, for plate warming, and for keeping food hot. Three heats are arranged for, a pair of rotary indicating

"Electroyl" Light Cooker.

switches being mounted on the outside casing. A self-basting attachment is fitted at the top, which avoids the necessity for turning or inspecting the joint during cooking, and a ventilator is provided for cooling the oven when necessary. By replacing the baster with a casserole or stewpan, simmering and steaming can be carried out simultaneously with baking. There is no need to open the oven at all while cooking is proceeding, the system of heat control and the provision of the thermometer permitting of uniform and certain results in a given time. The oven is opened by raising the domed cover with the handles provided, the lower compartment being reached by taking off the upper part of the oven. All parts are made detachable for ease in cleaning inside and out. Tests of the medium-sized "Electroyl" oven, made by a municipal engineer, show that a 6-lb. joint can be well and thoroughly cooked for an expenditure of 400 and an 8-lb. joint for 600 watt-hours. Simultaneously with the baking, plates were heated in the hot closet below by the downward heat from the element.

"Bastian" Oven. Another light and inexpensive oven of English origin is made by Bastian Electric Heating Syndicate, of London. It fits over a rectangular hot plate, which can also

"Bastian" Light Oven.

"Bastian" Hot Plate.

be used as a grill, for toasting or for heating flat-bottomed utensils, the oven lifting off for the purpose.

The hot plate is mounted on a cast-iron base. The grid is fixed on a copper cover, and when necessary can be easily and quickly renewed; cleaning also is a simple operation. Switches are provided to give two heats in the smaller sizes and four heats in the larger size. The maximum consumption in this case is 3 units per hour, and that of the smaller size $1\frac{1}{2}$, costing $1\frac{1}{2}$d. or 3 cents to run at full heat.

The overall dimensions of the smaller size are $5\frac{1}{2}$ inches high by 17 inches long and 14 inches broad. The larger size differs only in length, being 2 feet instead of 17 inches long.

The heating element consists of a number of spirals of nichrome wire enclosed in small tubes of quartz glass, which glow to a bright red within a few moments of switching on the current. Being fragile, these quartz tubes are protected from injury by a wire guard, but they are unaffected by contact with water or grease, although red hot. The Bastian hot plate is a very satisfactory device and in conjunction with the oven makes a complete cooking unit for a small household. Renewals of the heating unit are easily carried out at home, and are by no means expensive.

The oven is of thin sheet-metal with double sides, having an air space to minimise heat losses. In order that the best results in pastry baking may be obtained, it is advisable to use a top heater in addition, but for ordinary cookery the bottom heater

" Hot-point " Oven.

is quite sufficient, and it can deal with a 6-lb. joint quite satisfactorily; vegetables or a pudding being cooked at the same time.

" Hot-point " Oven. A small domestic oven for light duty is made by the American Hot-point Co., and is here illustrated. It is made of light sheet metal, with a drop-down door fitted with glass panel for examining food during the cooking process. The heating element is of special resistance wire placed at the bottom of the oven, and protected from injury through touching, or the spilling of water and grease. Three heats are provided, a rotary indicating switch mounted in front giving the necessary control. The current consumption is only about 450 watts, or less than ½ unit per hour. The cost of running at full heat is but ½d. or 1 cent per hour. Although taking so little and being so small in size, the " Hot-point " oven will accommodate and cook perfectly two large loaves of bread, a couple of

"Gilbert" Cooker.

pies, a large chicken or small joint. The cost of baking two loaves of bread, weighing 2 lbs. apiece, would be only .35d. or less than 1 cent. For such an operation the full heat would be maintained for twenty minutes and medium heat for a further thirty minutes.

The makers guarantee the heating element for 5 years, so that users need have no fear that breakdowns would be frequent or renewals costly. Current may be taken from any lampholder, since the consumption is no more than that of an electric flat iron.

I am able to describe a series of new designs of Electric cookers which are quite a departure from the usual practice.

"Gilbert" Cooker.
Showing Hot Plate raised and Grill folded down.

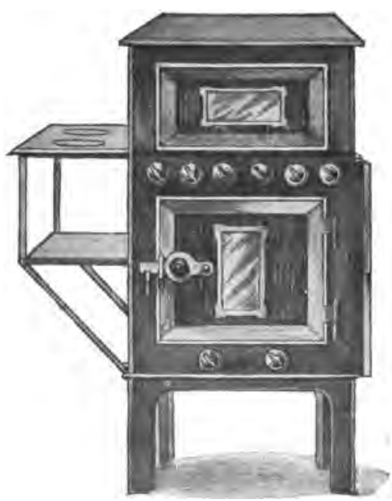
"Gilbert" Cooker. This make of cooker has many features novel to British practice. There are two ovens, the small one for Baking and the larger one for Roasting, being heated with 2 and 3 elements respectively. Each element having a double control enables the operator to adjust the heat to any requirement; the ovens are heat-insulated from the outer casing. The hot plate top is provided with 4 boiling discs each having 3-heat control. The edge of the hot plate is provided with a gutter which enables any liquid spilt on the top to run to a back outlet and collecting pot, thus protecting the elements and the lower

part of the cooker from injury; the sides are arranged to receive a grill which can be turned down flat when not in use or taken off, the under shelf acting as a plate or dish holder or warmer. The oven doors are provided with glass fronts to see how the cooking progresses, if required.

Two views are given, one showing the complete cooker ready for use, the other showing the top lifted, exposing the switch connections and facilities for removing any boiling disc. The switches controlling the ovens are equally accessible, the whole wiring being protected from injury or chance of short-circuiting.

The loading provided is 300 and 600 watts for the two 8″ boiling discs; 200 and 400 for each of the 2 smaller boiling discs, 300, 300, 600 for each oven element, and 400 and 600 for the grill, or a total loading of 6.4 kw. all full on; the average loading is, however, only 3 kw.—3d. or 6 cents per hour in full work.

"Franklin" Cooker. This follows from the same designers as the Gilbert Cooking oven, but is larger, the baking oven being on the top of the roasting instead of side by side—the heat insulation being the same. The hot plates, boiling discs and grill are fitted at the sides and are made to fold down out of the way or taken off and stored underneath when not wanted, switches and plug connections being provided for control. The heat control is the same as with the Gilbert Cooker; the ovens have a larger loading, and the total being 6.4 kw. the average working 3.2 kw.,—3¼d. or 6.5 cents per hour for full working.



"Franklin" Cooker.

"Newton" Domestic Cooker is of equally novel design, the principal feature being that the ovens are of oval shape, heated uniformly by the elements placed round the outside of the inner casing

"Newton" Cooker.

or in pockets distributed at the sides so that the bottom, top, and sides are uniformly heated at *high, medium* or *low* heat; the top heat being under separate control if desired. The internal construction is of special material, being both electrically and heat insulated, always clean and ideal for cooking. The connections are made in the back casing of the cooker and covered. The hot plate is provided with one 8″ and two 6″ boiling discs. Switches can be fitted on the cooker itself. In the example illustrated the switches are fitted on an enclosed panel on the wall at the side of the cooker with indicating lamp and fuses. A grill attachment can be hooked on at the side when required, controlled by the same switchboard. The loading is 300–300–600 watts for each oven, 300 and 600 for the 8″ boiling disc, 200–400 for the 6″ boiling disc, making a total loading of 3.3 kw. In average working the load is 2.1 kw., just over 2d. or 4 cents per hour when in full work.

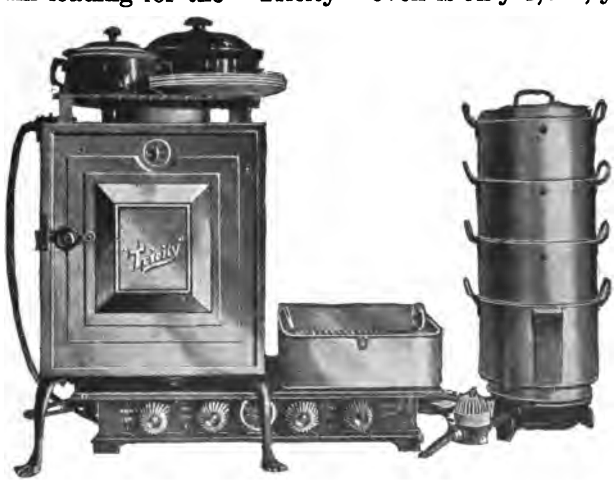
The object of the maker of these series seems to be a right one from an electric cooking point of view. The ovens proper are so constructed that they heat up very quickly with a fairly low loading, have no heavy metal connections to conduct the heat; while the heat insulation being of a special character the low loading is quite sufficient to maintain the proper cooking temperature.

"Tricity" Cooker. "Tricity" cookers are made by the British Electric Transformer Co., Ltd., London. Essentially the system comprises one or a number of circular hot plates or boiling discs, with two-heat control. These are made singly or in duplex form, the latter patterns having sockets at the ends to enable one or two additional discs being connected up to the main cooker. These extra or extension cookers may be used for boiling and grilling or, when inverted, for use as top heat to the "Tricity" oven. The latter is of polished sheet metal, with a circular hole at bottom and top to fit over the hot plate of the

cooker and to take the extension disc respectively. When the top heater is not needed, the hole in the oven top is closed by a lid.

The oven stands upon four legs, fits over either of the boiling discs of a duplex cooker, or over a single boiling disc. For baking meat and for high-temperature cooking, both top and bottom heat are necessary, the top heat, by means of a deflector, browning meat, cakes, and pastry and assisting in the maintenance of an even temperature throughout the oven. Above the oven is a hinged rack upon which plates or vessels may be placed, the heat given out from the top of the inverted boiling disc being sufficient to keep them warm. This rack is also convenient for airing clothes. If the rack is not required it will swing back, and the top of the boiling disc can be used to keep casseroles and other vessels at simmering heat, a great convenience when the oven is in use. The boiling discs are quite portable and light, and can be lifted off or placed on the oven in a moment.

Loss of heat is avoided by a highly polished surface all over, and so long as the brightness is maintained, so long will the efficiency be kept at a high level. With the oven running at a temperature of 400° F. it is possible to bring one's hand within half an inch of the side without feeling the slightest heat. The maximum loading for the "Tricity" oven is only 1,600, yet this



Duplex "Tricity" Cooker, with Oven, Grill and Extension Plate.

is sufficient to bring to cooking heat a space measuring 19 ins. by 16 ins. by 14 ins., while this temperature can be maintained at an expenditure of 400 watts. If the oven were run at full heat top and bottom for an hour, the cost would work out at 1.6d. or just over 3 cents, but in practice full heat is only required for about 40 minutes, the cooking being completed at low heat, costing .4d. per hour, or less than 1 cent.

The latest form of "Tricity" for larger households is the double-oven type. This is a combination of two 19 ins. by 16 ins. ovens, each being independent so far as cooking is concerned. The double oven fits over the plates of a Duplex cooker, and is used with two extension plates for top heating. Two hot cupboards are formed above, these being detachable. They are very useful for keeping cooked dishes or plates warm and take no additional current, the heat from the top plate being sufficient to maintain a suitable temperature.

When used for boiling water, the "Tricity" hot plate is somewhat slow, owing to its small current consumption, and to meet the demand for a quick boiling disc the makers have increased the loading from 800 to 850 watts, which materially reduces the time taken to heat water and do other work. Over any of the hot plates a silver-plated ribbed grill with grease tray can be fitted, and very beautifully can bacon, eggs, tomatoes, chops, steaks or kidneys be grilled in this way. Any ordinary utensils with flat bases can be used over the hot plates, but in order to ensure absolutely flat surfaces, the makers supply special vessels with copper bottoms, flanged so as to fit over the disc.

"Ferranti" Small Oven.

"Ferranti" Ovens. Messrs. Ferranti, Ltd., of England, who are well known as makers of electrical plant, have designed a large number of electric heating and cooking appliances, and I am able to illustrate two forms of Ferranti ovens. The first is a type for small

"Ferranti" Small Oven, Showing Internal Arrangements.

families and is not intended to meet the heavy cooking demands for which a larger oven is needed. The second is a complete electric cooker, suitable for large households.

The smaller oven is of cast iron, with a polished aluminium interior, the space between being lagged with heat insulating material. This construction combines some of the advantages of the polished unlagged type of oven with those of the heavy black patterns, losses of heat through conduction, convection and radiation being reduced to a very small value. The area of the oven inside is just over a cubic foot, which is enough to take a 6-lb. joint and a Yorkshire pudding, or a somewhat heavier joint by itself.

There is only one heating element, this being in the maker's standard circular hot-plate form, 7″ in diameter, consuming 850 watts, and costing .85d. or nearly 2 cents an hour to run. This unit is detachable, and plugs in the bottom of the oven. It can be used for boiling while in position, or for toasting. Two heats can be arranged for, the lower heat taking 300 watts. There is no switch on the oven, heat control being effected at a separate fuse and switch panel on the wall. Although there is no top heat, cakes and pastry will brown quite well, a deflecting plate ensuring an even distribution of heat and a circulation of the heated air throughout the oven. A new heating element can be fitted in a few seconds at small cost should it be necessary, but this is unlikely, as all Ferranti elements are guaranteed for

" Ferranti " Domestic Cooker. Wiring Arrangement.

2 years. Used in conjunction with the firm's breakfast grill with boiling disc, an outfit is secured which will take care of the cooking requirements for any small household.

The larger cooker shown in the above illustration comprises a complete " range " for all the cooking duty in a moderate-sized residence. On the hot plate are mounted two standard 7-in. single-heat boiling discs, rated at 850 watts; one two-heat simmering plate, measuring 12 ins. by 8 ins., and consuming 300 to 850 watts; and a grill, 8½ ins. in diameter, with a loading of 1,500 watts. The oven measures 21 ins. high by 14 ins. wide, and 14 ins. back to front, and contains three standard 850-watt 7-in. discs.

If the entire cooker were to be switched on and run for an hour, it would cost 6.6d. or 13 cents, since the total current consumption is 6,600 watts, but it is seldom that all the elements would be required simultaneously, and they would never be needed at full heat for an hour. In practice the running costs for oven and grill and boiling discs would be about 3d. or 6 cents an hour.

The oven can readily be dismantled for cleaning or for the replacement of heating units. The polished iron top plate is retained in position by its weight only, so that it can be lifted off in a moment. A cast-iron tray is supported immediately

below the top plate; its side and the edges of the holes are turned up to prevent any grease or water spilled on the top plate, passing to the connections beneath. The heating units pass through the apertures in the plates and tray, and fit them closely. The cast-iron tray may be lifted out when the units are withdrawn, and all connections are then accessible, as shown in the side view with the switch box cover removed. Each unit rests on three studs. These studs are adjustable, and the surface of the heating unit may be aligned perfectly with that of the top plate.

The oven contains, in addition to the three 7-in. discs, hinged shelf racks, shelves, heat distributor, and a lamp to illuminate the interior, an observation window being fitted in a convenient position. In the frame above the door is arranged a ventilator. The oven is lined with enamelled iron, and the space between the lining and the outer case is lagged to reduce heat losses. When the oven has been heated up, one of the three heating units is sufficient to maintain the temperature required.

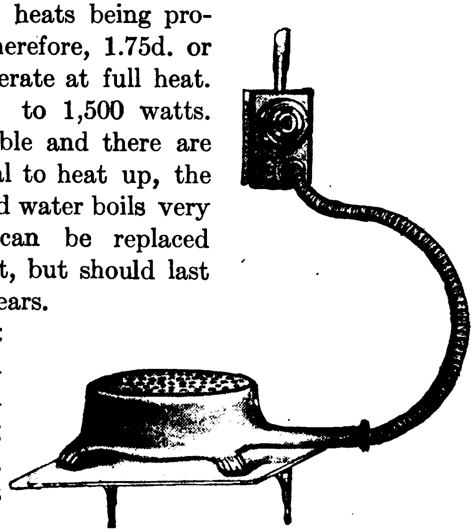
The distributor prevents the heat rising in the centre of the oven and burning the food; it also causes the heat to ascend at the sides, impinge on the top, and descend on the food, thus cooking it equally from all sides.

The resistance spiral which forms the basis of the heating element is thoroughly insulated; it withstands high temperature for long periods and is unaffected by rapid heating and cooling. It is totally enclosed in a circular case which rapidly attains a final temperature corresponding to a dull red heat.

The grilling element is constructed on the same lines as the standard heating element, and is arranged so that a maximum of heat is radiated downwards. In other respects it is exactly similar to the standard unit.

"Ferranti" Hot Plates.

"Belling" Cookers. So successful have the "Belling" electric fires proved in use that the makers have lately adapted the system to cooking apparatus. The fires are described under the heading of radio-convectors on a later page, the system consisting essentially of bars of fireclay on the surface of which are wound small spirals of nichrome wire, which glows with a bright red. In the "Belling" cooking apparatus, similar bars are used, except in the case of the boiling disc here illustrated, in which the spirals are of larger diameter and coiled more openly, being wound on the ribbed surface of a circular fireclay base. The glowing spirals are covered by a perforated steel plate, through which the heat passes to any flat-bottomed utensil placed on top. Water or grease spilt on the surface runs through the elements and passes out below them, and cannot do any harm. The case of the boiling disc is of cast iron, and the connecting wires are enclosed in pliable metallic tubing, which is taken to a control panel on the wall near by. This panel is provided with a rotary heat-regulating switch, indicating dial fuse and special socket. The whole device is earthed, so that shocks are impossible. An 8″ disc is loaded to 1,750 watts at full heat, two lower heats being provided for. It costs, therefore, 1.75d. or 3.5 cents per hour to operate at full heat. The 6″ disc is loaded to 1,500 watts. As the elements are visible and there are no large masses of metal to heat up, the disc is highly efficient, and water boils very quickly. The element can be replaced quickly and at small cost, but should last for at least a couple of years.



"Belling" Boiling Disc.

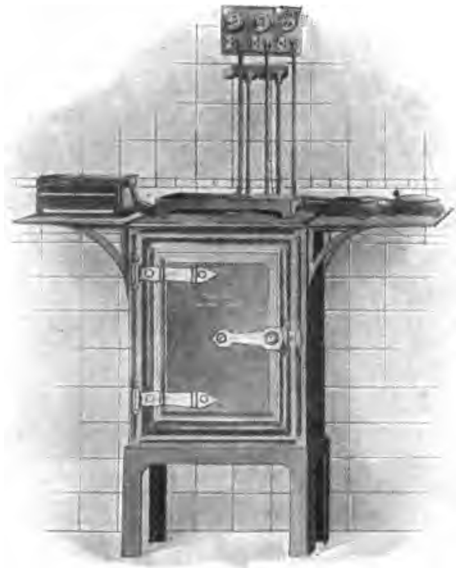
"Belling" Radiant Grill. The grill shown in my next illustration is an excellent design by Belling & Co., of Edmonton, London. The frame is built up of sheet iron, the top to which the

heating elements are attached, being removable for examination, cleaning or replacement. It will be seen that the heating unit is made up of the standard fire bars with spirals running at a bright red. Each bar is independent and can be detached in a moment. The glowing spirals are protected from accidental contact by a wire mesh, and the whole device

"Belling" Radiant Grill.

is earthed through the flexible metallic tubing in which the connecting wires are enclosed. A separate control panel on the wall is used for regulating the heat, three variations being possible. The whole of the bars may be used or only a portion, according to the quantity of food being grilled. At full heat the grill takes 2,300 watts, costing 2.3d. per hour or 4.6 cents to operate Owing to the fact that the elements cover the whole surface of the grill, very uniform heating is secured.

"Belling" Cooker. My next illustration shows a complete cooker built up on the "Belling" System. The oven is of cast iron and stands on legs, making it very convenient in use. It is heated by the standard fire bars placed at the bottom, with 3-heat control, and so arranged that at all heats, the oven temperature is uniform throughout. It is rated at about 2,300



"Belling" Complete Cooker.

watts at full heat, costing 2.3d. or 4.6 cents per hour to operate, but of course, full heat is only needed to bring up the oven quickly to a roasting temperature. On top of the oven is a flat plate, with side shelves supported on brackets. On this is placed a grill, loaded to 2,000 watts, and 3 boiling discs, each taking 1,750 watts at full heat. Oven, grill and boiling discs have 3-heat regulation, the control being effected at the switch and fuse panels shown on the wall. The whole apparatus is earthed to avoid the possibility of shock to the user. It will be seen that over one of the boiling discs is an extension plate, flush with the upper surface. This is useful when it is desired to heat up simultaneously several flat-bottomed utensils, each of which is partly over the hot plate and partly on the extension plate. The complete cooker makes a compact outfit for a small household and is not expensive to buy or to maintain, all the elements being readily replaceable. It should be added that all the connections are made outside, so that no heat can reach them, an important consideration that is sometimes overlooked by designers of electric cookers.

"Falkirk" Domestic Cooker. The Falkirk Iron Co. are one of the oldest manufacturers in Great Britain of cooking apparatus, and they have lately designed a complete range of electrically-heated cookers, as well as of electric fires, using for the latter only register grates adapted for electric heating.

"Falkirk" Domestic Cooker.

The cooker I illustrate is only one of a number of new patterns and has many interesting features. It is of cast iron throughout, and strongly constructed to withstand continuous use in the kitchen. The oven has a drop-down door forming a convenient shelf when open. It is white enamelled throughout inside, and measures 18″ wide by $18\frac{1}{2}$″ deep by 14″ high. It is double cased on all sides, and packed with 2″ of silicate of cotton. The heating elements are arranged at both sides and carried by readily detachable supports to allow of easy replacement when necessary. They are rated at 3,000 watts at full heat, costing therefore 3d. per hour to run or 6 cents. Top heat is only needed for a few minutes until the oven is hot, the lowest heat being then sufficient to maintain the cooking temperature. The oven door is fitted with a glass inspection door so that the cooking can be watched without opening the oven, and a ventilator is provided. It will be noticed that the oven stands upon detachable legs, 11″ high, a comfortable height above the floor level. The width and depth of the oven permit of the roasting of very large joints—meat or poultry weighing from 30 to 40 lbs. being cooked to perfection in the oven illustrated. Above the oven is a large grill and hot cupboard. This is rated at 1,500 watts, costing 1.5d. or 3 cents per hour to run at full heat. It has 3-heat control, all the switches for controlling the cooker being mounted on a separate panel fixed to the wall, where they are convenient for use and well away from the heat. On the top plate or hot table are two 8″ boiling discs loaded to 1,200

watts, one 6″ disc taking 750 watts and one 12″×9″ simmering plate heated by the grill elements. All the discs have 3-heat control. The grill, I may add, is fitted with a parallel rise-and-fall arrangement operated by an outside handle, so that the food may be placed at any required distance from the heating elements, which, by the way, are protected by a stout metal grid, the whole apparatus being earthed. All the internal wiring is carried to a large terminal chamber at the back where it can be examined and where it is free from risk of damage from heat or from spilling liquids or grease.

A smaller model is made by the Falkirk Co. which measures over all 22″ wide by 20″ deep and 34″ high, with an oven loaded to 2,000 watts, a griller-toaster and two boiling discs.

Electrical Co.'s New Cooker. Among the many designs of electric cookers to which I have already referred, there is none that resembles the pattern lately introduced to the British market by the Electrical Co., Ld., Charing Cross Rd., W. C., an illustration of which is here given. It has been built to withstand continuous usage in the kitchen, but is of artistic design, and has a most cleanly appearance, the sides and front being covered with a pure white enamel, the mountings and fittings being nickel plated and highly polished. This cooker is an ornament to any household, and can be kept spotlessly clean by the simple process of washing.

The cooker comprises a spacious oven, with drop-down door, forming when open a shelf for holding plates and dishes; surmounted by a hot-cupboard with a grill and toaster, three boiling discs being arranged on the top plate. The oven elements are quite different from those used in any other system. They consist of a special alloy wire wound in zig-zag fashion between two mica plates which in turn are enclosed between sheets of flat iron, held tightly together by grub screws, the edges of the plates being packed with asbestos to prevent the entrance of grease or moisture. It will be seen that the large metallic surface assists materially in conducting and distributing the heat uniformly throughout the oven. There are two such heating plates in the oven, and they can be placed at varying heights to suit the work in hand. At the back of the plates are three projecting

pins to which the ends of tbe resistance wires are taken. These pins fit into recessed sockets at the back of the oven, the flesh being merely pushed into position and making contact automatically. Being detachable, the shelves can be removed for cleaning or replacement. The total loading of the oven is 1500 watts, costing to run at full heat, $1\frac{1}{2}$d. or 3 cents per hour. Two

Electrical Co.'s Domestic Cooker.

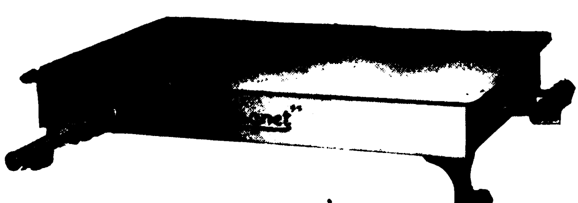
lower heats are arranged for, and after starting cooking at the high heat, the cven temperature can be maintained at the third or low heat position.

The grill and toaster within the hot-cupboard has exposed wire elements, which are easily detachable in the same manner as the oven elements. They are rated at 1500 watts, with 3-heat regulation. Each of the three boiling discs on top is self-contained,

the elements being wound between mica discs and fitted between two iron plates. They have projecting terminal pins underneath, fitting into sockets on the crown plate, and can readily be removed for cleaning or renewal. There are two 8-inch discs taking 1250 watts apiece, and costing $1\frac{1}{4}$d. or 2.5 cents per hour to run at full heat, and a 660-watt 6-inch disc, costing .6d. or just over 1 cent per hour. All the boiling discs are arranged for 3-heat regulation.

The switches are mounted above the hot-cupboard on the front of the cooker, and are of the rotary pattern with black lever handles. They give four heat positions, "off," "low," "medium," and "high," these degrees being marked plainly on the white surface, so that the cook can see at some distance exactly what part of the cooker is being used and what degree of heat is being given to any disc or the oven.

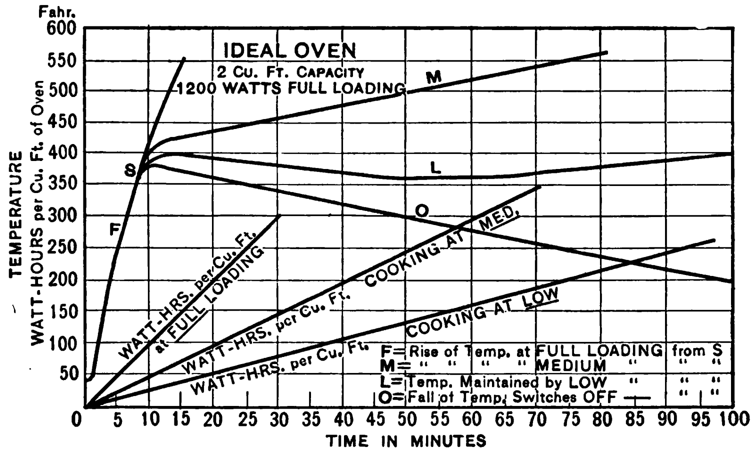
A nickel-plated rail is fitted in front of the switches, and this not only prevents the switches being caught by the clothes of the operator, but acts as a drying rail for airing clothes, towels, or dusters. The crown plate below the boiling discs is of white enamel, and has raised edges and flanged holes surrounding the sockets into which the 3-pin plugs of the boiling discs fit; thus it is practically impossible for any liquid that may have been spilt over, reaching the contacts. To assist the cleaning process, the whole of the top plate lifts up, hinges being fitted at the back. The cooker is well made and is a most interesting example of modern design.



G.E.C. Hot-plate.

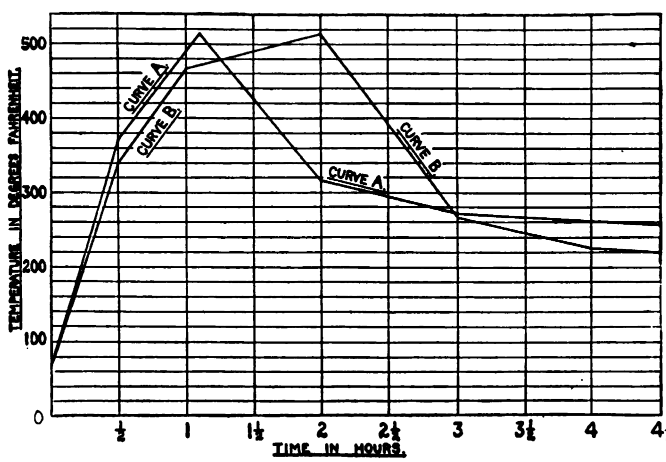
OVEN EFFICIENCIES

The accompanying Graphs are of interest as showing the high efficiency obtained in practice with electric ovens. Graph 1 is tabulated for an ideal oven of 2 sq. ft. capacity with temperature curves for high, medium and low heats. Graph 2 from a small Ferranti oven, similar to that illustrated on page 133, compared with a bright unlagged sheet-metal oven. In the former, the advantage of the bright surface to counteract heat losses are combined with the greater mechanical strength and lasting qualities of cast-iron construction, a bright interior lining being surrounded by a heavily lagged case. Curve *A* is that of the lagged oven, curve *B* that of the unlagged polished oven. The former is loaded to 717 watts per cubic foot at high heat, and 192 watts at low heat, while the latter is rated at 773 and 193 watts per cubic foot at high and low heats respectively. In 65 mins. oven *A* reached a temperature of 516° F., while 120 mins. were taken by oven *B* to attain this degree. After switching off, the oven *A* cools down to 217° F. in two hours, the unlagged oven to the same point in half that time. In 30 mins. after switching on, oven *A* reached a temperature of 370° F., which is ample for sealing the juices of the meat, in fact a lower temperature, such as that attained in 20 mins. (320° F.), is sufficient for the purpose. A test with a 5-lb. joint of meat showed that the total power consumption to cook the meat thoroughly was 1000 watt-hours, or just a unit, costing 1d. or 2 cents. The oven was first heated up for 30 minutes and the full heat maintained for a further 30 minutes. The current was then switched on and off at 20-minute intervals until the joint was cooked. Graph 3 is taken from a similar Ferranti oven. Curve *A* shows the temperature rise with full loading. Curves *B* and *C* show the temperature maintained by medium and low loading respectively and curve *D* shows the fall of temperature with switches off. The full load was switched down at point *X* in each case.



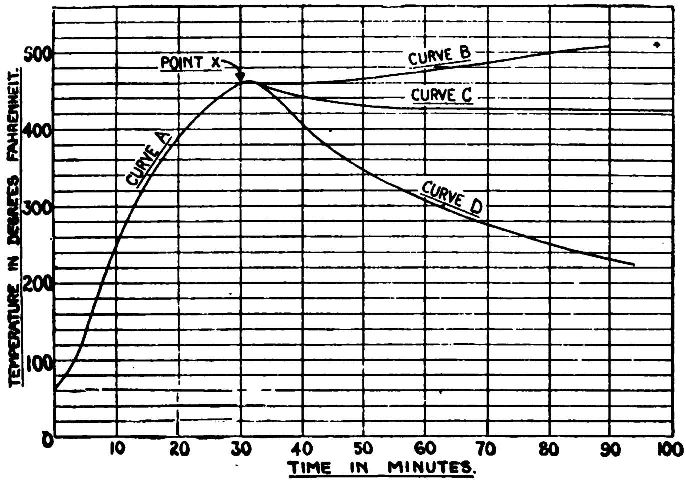
Graph 1.

Temperature Curves of Ideal Electric Oven.



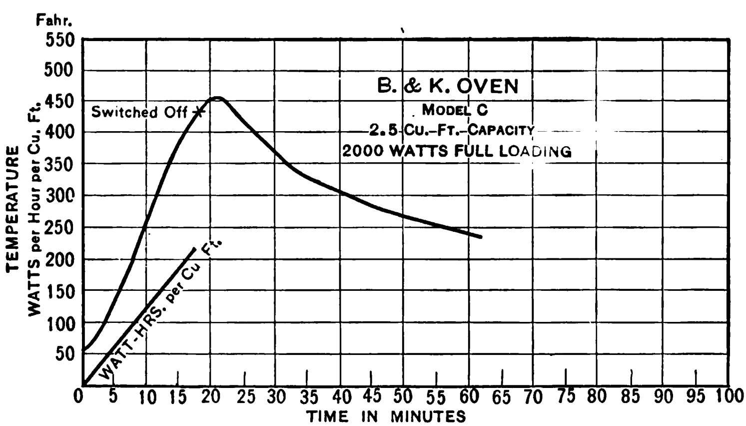
Graph 2.

Temperature Curves of Lagged and Unlagged Ovens.

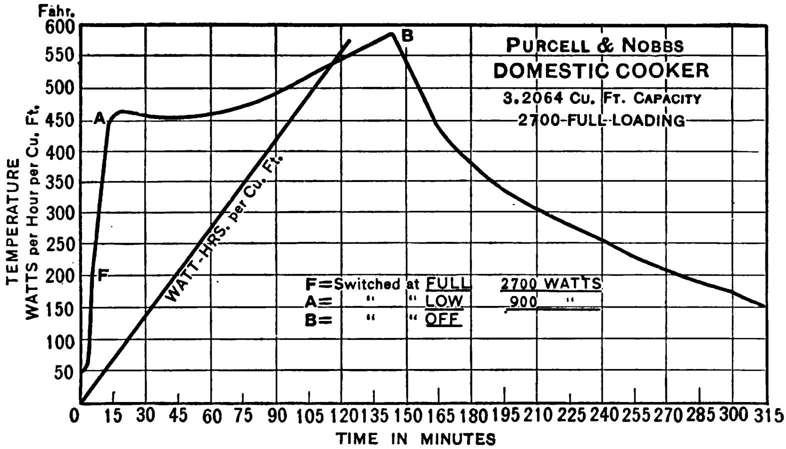


Graph 3.

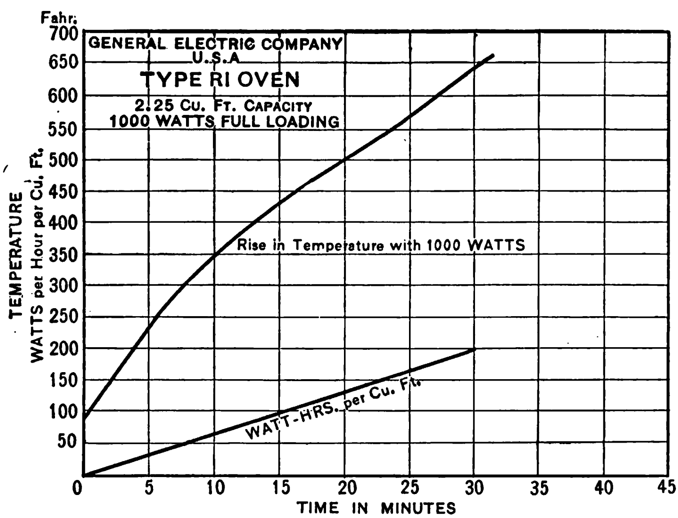
Temperature Curves of "Ferranti" Oven.



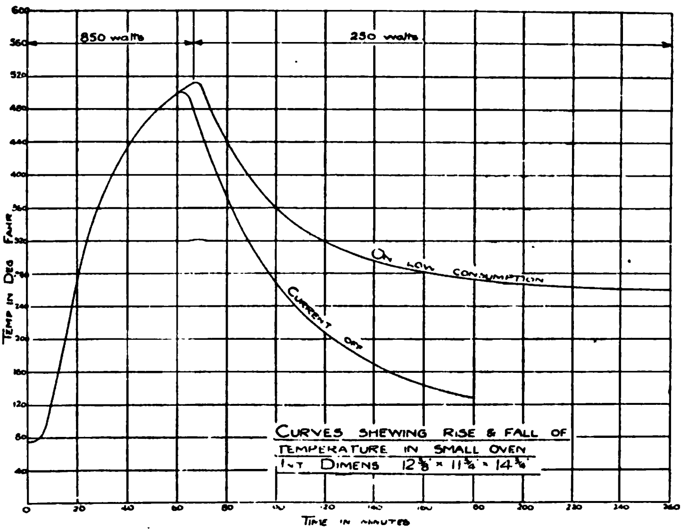
Graph 4 is taken from a B. & K. Model C. cooker. The curve shows the temperature rise with full loading and the fall when switched off. It also indicates the watt hrs. per cu. ft. capacity.



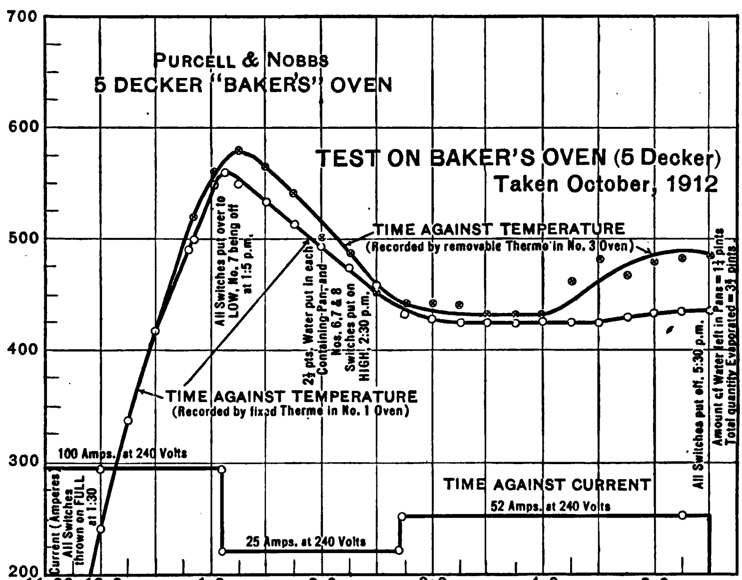
Graph 5 has been tabulated from the reading of test with a Purcell & Nobbs Domestic cooker.



Graph 6 has been tabulated from the tests with Type R. 1. cooker of the General Electric Co. of America.



Graph 7 is plotted from tests on a Ferranti small oven with low loading. The wattage at *full* load being 687 watt-hrs. per cu. ft. and at *low* load 202 watt-hrs. per cu. ft.



Graph 8 shows curves of baker's oven.

General Electric Co.'s Cooker. The new type R. 1 Electric Cooker, of the General Electric Company, of America, contains many distinctive features. The height is $34\frac{1}{2}''$, width $33\frac{1}{2}''$, depth $26''$.

All exposed surfaces have a blued steel finish, which resembles gunmetal, is very durable, and easily maintained in its nice clean appearance. A high back is provided having a $10''$ shelf. All the elements are movable and standardized, so that in case of any new element being required it can be readily exchanged.

The oven measures $18''\times18''\times12''$, is heat-insulated by $1\frac{3}{4}''$ in thickness of calorox, and welded steam-tight. The heating elements consist of two $10''\times7\frac{1}{2}''$ encased wire brazed to $\frac{1}{16}''$ plate of non-oxidizing metal, fitted in recesses at top and bottom. The top element also acts as a griller or broiler, and is held in position by means of four studs and clamps. The *hot plate* at top is provided with two cooking discs and three steaming pans.

Each cooking disc or stove consists of a top plate of non-oxidizing metal, with a steel shell which forms a bottom casing. An $8''$ encased wire unit is brazed against the under side of top plate. The outer edge is bent downwards to support the cooking top. The top edge of the bottom casing is bent over inside

the edge of the hot plate, and these two parts are welded together. The bottom casing is packed with calorox. There are three heats to each, and connection is made by means of stud terminals connecting to terminal blocks on porcelain fitted on the under side of the bottom casing.

The steamers are $8\frac{1}{2}''$ diameter and $6\frac{7}{16}''$ deep. They consist of two metal shells which are electrically welded together with $1''$ calorox insulation between. The inner shell is of non-oxidizable metal, and the outer shell of sheet steel. Elements similar to the hot plates, but of smaller diameter are fitted to the under side of the bottom of the inner shell. Aluminium vessels of 3 quarts capacity each fit into the 3 steaming compartments.

The controlling switches are placed on the cooker under the front part of the hot plate, and are placed at an angle so that the dial may be easily read when the operator is close to the apparatus. The cover of the switches is easily removable, and the switch parts replaceable from the front. A name plate under each switch handle indicates the element or elements it puts in or out of operation. Movable fuses are provided for all elements below the switches. These are covered by a sheet-metal flat door, and a similar sheet-metal plate protects the line wire and local terminal blocks. It is seen that every provision is made thoroughly to protect each element from injury of any kind. The high temperature does not affect the switches, fuses, or the internal wiring.

The connection to the oven

provides for two heats to the bottom—500 or 1000 watts, and one heat 1000 watts to the top. The switches are, however, so arranged that the top and bottom are not on together (unless specially required to get a quick heat), so the maximum rate of consumption may be taken as 1000 watts.

The two hot plates have a loading of 250, 500, 1000 watts each. The 3 steamers have a loading of 200 watts and the total maximum loading is, therefore, 3600 watts, costing 3.6d. or just over 7 cents per hour. The average working of these cookers in practical use is given on page 149.

"Copeman" Automatic Cooker. The special feature of the Copeman oven is its automatic control. A thermometer on the oven doors and a time-switch are provided, by means of which the exact heat required in the oven can be maintained constant or varied as desired automatically, and the current switched on and off at any pre-determined hour without attention.

The Copeman Cooker will carry out all the culinary operations needed by a family of from 2 to 20, according to the size of stove installed. It is constructed with a wooden frame, the ovens being of stamped aluminium with nickelled mountings, the top

"Copeman" Automatic Cooker.

of the cooker itself, in which the hot plates are fixed, being also of metal.

The heating elements, of which there is one in each compartment, can be removed and attached to the top of the stove for frying, broiling, etc., or extra elements may be provided for this service, operated by separate control switches.

The element will retain heat for a considerable length of time after having been removed from its compartment, is so neat and cleanly that it can be placed upon the table when desired, and when so utilized looks very similar to an electric plate-warmer and serves the same purpose without any expense whatsoever, for the heat is stored within it, and, having once been utilized to prepare the dish, it is now maintaining it at a proper temperature.

The frame is of prepared wood, the cooking compartment being insulated from same with heavy asbestos strips, and the compartments themselves are insulated from the case by one-half inch of dead-air space and 2½ inches of mineral wool, which results in a perfectly cool exterior. The stove in full operation radiates no more heat in a room than an incandescent lamp.

It is possible to cook with it a whole dinner. The main switches are closed and the small knife switch beside the clock opened. The clock is then set to turn the current into the stove at the selected time. When the clock closes the switch, the current is applied just long enough to bring the foods to a proper temperature, sufficient for breaking down their starchy particles.

Then the current automatically shuts off, but the dinner continues to cook with no further expense, the stored-up heat in the oven and heating element being sufficient for the purpose.

Meals can be kept hot for hours with no expense whatsoever. Food cooked by this new process has a wholesomeness obtainable by no other means. In the early patterns the internal parts were made too light and fragile for rough usage; this has, I believe, been remedied and the whole apparatus very much improved.

British Prometheus Cookers. This illustration shows the British Prometheus Company's domestic cooker for a household of 8 persons. It is constructed of cast iron, with heavily-lagged oven, the latter supporting a hot plate with grill and boiling

British Prometheus Oven.

discs. The elements for the oven and boiling discs are of nichrome or similar high-resistance alloy, wound over flat strips of mica and enclosed in thin iron envelopes, the heating wire being insulated, of course, from the metal casing. Each strip is self-contained and independent of the others, so that in the unlikely event of a breakdown, only one out of the dozen strips used is affected, which will reduce but slightly the heat produced. They are protected from mechanical injury and from the action of the juices and grease. The strips are held in frames on both sides of the oven, and are controlled by switches on a panel fixed to the wall near the cooker. Three heats are arranged for, the maximum taking 3000 watts and the medium and low 2000 and 1000 watts respectively, the running costs at the 3 heats being, therefore, 3d. or 6 cents, 2d. or 4 cents and 1d. or 2 cents per hour. The grill is loaded to 1200 watts and has an exposed wire element, protected by a metal grid. There are 2-boiling plates, 6″ in diameter, both rated at 800 watts, with a low heat taking 250

"Hughes" Medium Cooker.

watts. These plates are flush with the top to allow of several flat-bottomed utensils standing over them at one time. Internally the oven measures $18'' \times 11\frac{1}{2}'' \times 12''$ and the grill $8'' \times 6''$.

"Hughes" Electric Cooker. Several patterns of electric cookers are made by the Hughes Electric Heating Co., Chicago, and I illustrate two of the most popular models, one medium and one large type. In conformity with the usual American practice, the oven is raised on legs so as to be easily accessible to the user. The body of the cooker is built up of heavy gauge rolled steel, the legs and top being of cast iron with nickelled edges. The medium pattern oven which measures inside $18'' \times 12'' \times 12''$, is heavily lagged with asbestos to minimise heat losses by radiation, and is heated by two elements rated at 880 watts, or eight-tenths of a unit per hour at full heat. Rotary indicating switches above the oven permit of heat regulation, three heats being arranged for in the case of both oven elements and the hot plates above. The oven door is hinged at the bottom and drops down to form a shelf on which food may be placed.

There are three circular hot plates above the oven, each taking 880, 440 and 220 watts at full, medium and low heat respectively. Thus the user can heat the kettles or other utensils rapidly or slowly as desired. Any ordinary vessels with flat bottoms can be heated over the hot plates, which are flush with the surface, so that saucepans,

"Hughes" Large Electric Cooker.

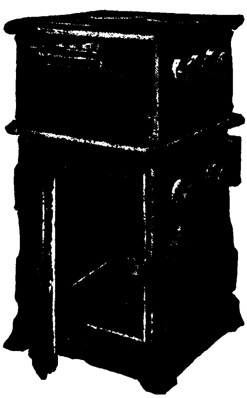
etc., may be placed directly over the part at maximum heat or moved to one side to simmer slowly. The cooker has a sheet metal back behind the hot plate, and carries an airing and warming shelf on brackets. All heating units in the Hughes cooker are guaranteed for a year.

Simplex Cooker

"Simplex" Cooker. An exceedingly attractive cooker of American design is that made by the Simplex Electric Heating Co., shown in the accompanying illustrations. The apparatus, which forms a complete cooking outfit, is built up of cast iron, the oven sides being of sheet metal, packed with heat-insulating material. Two heating units, one at the top and the other at the bottom, are used for the oven, the current consumption being at the rate of 1,300 watts, costing at full heat 1.3d. or just under 3 cents per hour. Inside, the oven measures $15'' \times 12'' \times 11\frac{1}{2}''$, but there are several larger sizes made by the Simplex Co. Raised above the top of the oven about 3″ on short legs, to allow of cleaning, are two disc stoves, six and eight inches in diameter respectively. These are intended for heating flat-bottomed utensils, special patterns with a simple locking device being provided by the makers. They are of copper, heavily nickel-plated, and are designed to fit very closely to the heating surface, in order to insure the maximum efficiency. Each of the disc stoves and the oven elements are arranged for 3 heats, these being controlled by rotary indicating switches mounted above the oven in front. The large disc is rated at 735 watts, and the smaller one at 440 watts, when at full heat, the cost of working being $\frac{3}{4}$d. or 1.5 cents, and .4d. or nearly 1 cent per hour respectively. There is also a broiler or grill raised on short legs, and taking 1300 watts, or 1.3 units per

hour. The latter has a corrugated top, slanting slightly towards a grooved end, which receives the juice and fat from the meat when being grilled. A separate smooth top fits on the grill for making toast, griddle cakes and so forth. Simplex cookers are made in several sizes for families from 2 to 20, and the large ones for restaurant use.

British General Electric Company's Cookers. The cooker I illustrate is intended for the use of families of average size, and is constructed of cast iron throughout, in plain but solid design. The interior is vitreous enamelled, and all the interior fittings can be removed for the purpose of cleaning. It is double-cased, and between the inner and outer cases is a thick layer of lagging, which effectively prevents heat losses. The heating elements are placed on each side of the oven, and are easily removable from the outside. They are wired so as to give one-third, two-thirds, and full heat, evenly distributed from both sides at once. The heating coils are simple in construction, fixed to substantial firebrick slabs. They attain a red heat, so that cooking is effected partly by radiant heat as before a fire. The top structure provides a grill at left-hand side large enough to grill four chops or three steaks at once, fitted with adjustable gravy pan and grid, and grills by deflecting the heat downwards. At the same time the top of the plate is arranged for boiling. At the back are two boiling plates, one of which is provided with a graduated switch giving three degrees of heat, let in level with the surface of the top plate. Each of these elements is removable for replacement. A hot chamber is provided for keeping food warm. Control is provided by rotary switches fitted on the side of the oven, or by terminals mounted on the oven and a separate switchboard. The dimensions are as follows: Oven inside, $20'' \times 15''$; hot-plate, $18'' \times 17\frac{3}{4}'' \times 12''$ deep. The maximum loading in the oven is 2500 watts, with a minimum of 500, and of the hot plate 3400 watts



British General Electric Cooker.

with all on. The running cost of the oven at full heat is, therefore, 2½d. per hour or 5 cents, and at low heat ½d. or 1 cent.

"Nightingall" Oven.

"Nightingall" Oven. This oven, of which I give the illustration, is the only example at present of an English-made cooker equipped with automatic heat control. It is of Australian origin, and the British manufacturing rights have been acquired by the General Electric Co. of England. It has been designed on substantial lines to withstand rough usage, and in its present form consists of a large oven for roasting joints, and for baking cakes, pastry, and so forth. It is particularly suited for Colonial requirements, where the demand is for an oven of large size, little use being found for a grill or boiling disc. To the English market, these will probably be added, so as to form complete cooking equipment. The heating element is arranged at the bottom, and consists of an iron frame carrying grooved insulators, over which a spiral nichrome wire is wound. It is rated at 1800 watts at full heat, 3 lower heats being arranged for. The entire unit is detachable, the connections being taken to three projecting pins at the back, which fit into corresponding sockets at the back of oven. This facilitates cleaning and renewal, any user being able to fit a new spiral at small cost and trouble.

"Nightingall" Oven, Door Open.

Adequate heat insulation is afforded by some 3″ of slag wool which entirely surrounds the cooking space. The heat control is automatic, the rotary heat-regulating switch being rated in degrees Fahrenheit and not in watts. A thermometer is inserted in the side of oven, and contains contacts which open or close the circuits through a magnetically-controlled dash-pot filled with mercury. If it is desired to maintain the temperature at 400° F. the switch is set to this marking, and the thermometer ensures that this heat will be kept up within 2 or 3 degrees, indefinitely. Higher heats give a temperature up to 600° F., the minimum being about 200° F. The oven is somewhat slow in heating up, but does its work well, cakes, and bread being beautifully cooked and browned on top in spite of there being no top heat. This is due to the excellent diffusion of heat throughout the cooking space. An even heat being maintained all over.

Large "Plexsim" Cooker.

Plexsim Cooker. A cooker representative of English practice is that here illustrated, which is made by Simplex Conduits, Ltd., of Birmingham.

The internal dimensions of the oven are 18 ins. by $11\frac{1}{2}$ ins. by 12 ins. The top cooker consists of two 6-in. boiling discs with perfectly smooth surfaces, so as to ensure even contact with the bottom of the utensils to be heated. The boiling plates consume current when at full heat at the rate of 800 watts, and at low heat 250 watts, the running cost being .8d. and $\frac{1}{4}$d. per hour respectively, or less than 2 cents and $\frac{1}{2}$ cent.

A grill 9 ins. long by 6 ins. wide is enclosed in a strong pierced metal case preventing accidental contact and possible damage. The elements comprising the grill are rigidly supported, and so constructed that the expansion and contraction of the ribbon-section resistance wire is taken up automatically, obviating any short circuiting between various turns. The grill is rated at 1200 watts, and costs, therefore, 1.2d. or just over 2 cents per hour to run.

The oven elements are fitted at each side, and are readily detachable. They are fitted in a novel manner, which provides an air-space between them and the actual side of the oven, giving an air-duct along which the hot air may rise to the top of the oven, maintaining a constant circulation, which has been found in practice to result in that uniformity of temperature, both at the top and the bottom, which is so necessary to successful culinary operations. In use the variation in temperature between the bottom of the oven and the top does not show a difference of more than a few degrees. At high heat the oven elements consume 3000 watts and at the low heat 1000 watts, the running cost being accordingly 3d. and 1d. per hour, or 6 and 2 cents.

Carron Company's Cookers. The Carron Company is one of the few British makers that realise the advantage of the raised oven, and the first illustration I give of a Carron Cooker shows a typical design for a small family, based upon the well-known Larbert coal-range model. This consists of oven for roasting and baking, two hot plates for boiling, stewing, etc., a double grill and toaster, and a hot closet for keeping food warm, warming plates, or for slow cooking, and will do the cooking of an ordinary household. The hot plates and elements for the oven are each provided with three heats; thus the temperature can be quickly raised and afterwards maintained at any lesser degree with the minimum consumption of current, thereby ensuring economy. The loss of heat through outward radiation is reduced to a minimum by heavy lagging around the oven.

The heating elements are so arranged that they may be easily replaced at small cost without returning the cooker to the makers.

The oven is lined with mottled enamelled linings and hangers,

with runners for shelves; two grid shelves and one sheet shelf. The oven is fitted with an inner glass oven door so that food can be examined while cooking, without loss of heat. Grills have white enamelled sides and back, and are fitted with grill tins. Each range is provided with two switches for oven, one for each hot plate, each of these giving three ranges of heat. Separate switches are provided for grills and hot closet and two plugs and sockets are fitted for connecting the cooker to the main cable.

"Carron" Large Domestic Cooker.

The oven measures 12″×18″×16″ inside and is loaded to 2800 watts at high heat, the low heat taking 800 watts. The cost of running at full heat is, therefore, 2.8d. or nearly 6 cents per hour, but it is not necessary to keep the oven at full heat for more than ¾ hour in any circumstances, its heat being maintained at an expenditure of about one-third of the maximum. The grills have only one heat, and are rated at 1500 watts (costing therefore 1½d. or 3 cents per hour to run). The two boiling plates are 8″ in diameter and take 1000 watts at high heat and 500 watts at medium heat. A smaller disc is provided, 7″ in diameter, this being rated at the same wattage. The hot closet measures 18″×9″×16″ inside, and is heated indepen-

dently by an element taking 1000 and 500 watts at full and low heats respectively. Switches for controlling the heat are mounted at the side of the cooker, or may be fixed on a panel attached to the wall. As the boiling plates are flushwith the top surface of the cooker, ordinary flat-bottomed utensils may be employed, and by moving them away from the hottest part, the rapidity of boiling or simmering may be regulated to a nicety.

Small Carron Cooker.

Carron Co.'s Grill and Oven or Hot Cupboard.

The larger Carron cooker for domestic use has an oven, large grill, hot closet, two circular boiling plates and a warming plate. Oven and hot closet are fitted with mottled porcelain enamelled linings inside. The oven is fitted with removable hangers and grid shelves; the door has an inspection window, and a thermometer can be fixed but is not recommended, so that the temperature of oven can be ascertained without opening the door. The oven is double-cased and packed with heat insulating material, giving high efficiency. The oven measures inside $16'' \times 21\frac{1}{2}'' \times 15''$ and is loaded to 3000 watts at full heat, the grill being


"Eclipse" Electric Breakfast Cooker.

rated at 1300 watts, and the boiling plates at 800 watts.

The heating elements are so arranged that when necessary they can be easily replaced without returning the cooker to the makers.

Heat control is effected by rotary indicating switches mounted vertically at the side of the oven, fuses being provided for every circuit.

In addition to domestic cookers, the Carron Company makes large suites for restaurant, hotel, and ship use, and has supplied a great number of grills, hot cupboards and other cooking and heating apparatus for industrial applications.

An excellent example of grill or broiler and hot cupboard is here illustrated.

"Eclipse" Cookers. One of the electric cookers best known in England is the "Eclipse," made by the Electric & Ordnance Accessories Co., of Birmingham. The makers have done much pioneer work and have assisted to popularise electric cooking by giving public demonstrations at scores of places throughout the country. "Eclipse" cookers are similar in appearance to the standard English gas stoves, and are built up substantially in cast iron, with oven near the floor level, surmounted by boiling plates and grill. In the cooker illustrated, the oven measures inside $21'' \times 13\frac{1}{2}'' \times 13\frac{1}{2}''$, and has its heating elements, consisting of nichrome wire wound over flat strips of mica, arranged either side. These elements are rated at 3000 watts at full heat, and 1000 watts at low heat, the running cost being, therefore, 3d. (6 cents) and 1d. (2 cents) respectively. The grill measures


"Eclipse" Domestic Cooker.

$10'' \times 7\frac{3}{4}''$ and consumes current at the rate of 1200 watts. There are 2 circular boiling discs $7\frac{1}{2}''$ in diameter, rated at 800 and 250 watts for full and low heat respectively. Heat control is effected by rotary indicating switches mounted just beneath the top plate on the right-hand side. In its latest cookers, the Company makes all the elements replaceable, so that any one which may break down can be exchanged for a new one without disturbing the remaining equipment.

A useful companion to the complete stove is the breakfast cooker shown in the previous illustration. This is a portable device for standing on a bench or table, and is equipped with two $7\frac{1}{2}''$-boiling discs, with 2 heats, and a combined hot plate and grill, the loadings being similar to those in the complete cooker. A white enamelled crown plate is provided, and the appliance is mounted on a substantial cast-iron base with feet. Rotary indicating switches for heat control are mounted at the side.

"Jackson" Electric Cookers. A British firm that has shown great activity in the cooking and heating business is the Jackson Electric Stove Company of London. It has supplied a large number of domestic cookers to private users and has equipped many restaurants and staff kitchens with electric cooking apparatus. I am able to illustrate two representative models of Jackson cookers, the domestic single and the double cookers. The latest pattern of single cooker for small families is of cast iron, with porcelain enamelled sides, giving a tiled effect. The oven is surmounted by a hot plate containing grill and boiling discs. Internally the oven is white-enamelled, and arranged for three heats, the maximum loading being 2200 watts. The running cost at full heat is thus 2.2d. or just over 4 cents per hour, this being reduced by two-thirds as soon as the oven has warmed up. The heating units are of special resistance wire carried in frames both sides of the oven, and so fixed that they can readily be removed for inspection or renewal, while being amply protected from mechanical injury. Failure in any one unit does not shut down the oven, for all run independently, and merely a slowing up of the cooking operation results, although even this is unlikely, since the full number of units is only needed for the initial warming-up, the cooking temperature being maintained at one-

third of the full consumption. There are two 8″ boiling discs on top, rated at 1200 watts, with three-heat control, and a 6″ disc with a maximum consumption of 800 watts, also with three-heat control. The grill measures 11″×8″, and takes 1100 watts. Between the oven top and the hot plate is a hot cupboard fitted with drop-down door forming a shelf. This has no heating element, plates and food being kept warm by the heat escaping

"Jackson" Domestic Cooker.

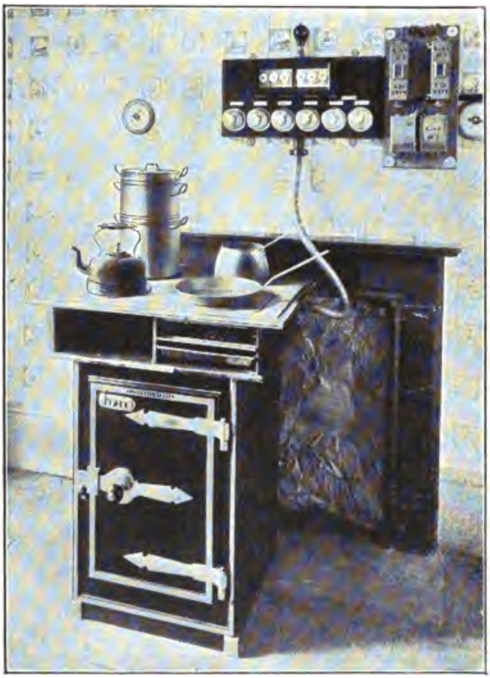
from the grill or boiling rings. The oven door is fitted with a ventilator and glass panel, the latter being useful for watching the cooking process without opening the door. Overall the dimensions are 36″ high×25″×21″, the oven being heat-insulated on all sides with slag-wool lagging. The stove forms a complete and compact cooking outfit for a family of eight. Heat control is effected at a neat switch panel on the wall, with or without fuses and pilot lights.

"Jackson" Double Cooker.

The Jackson Double Cooker is made in four sizes, and is intended for large private houses or small restaurants. It consists of two domestic ovens placed side by side under one hot plate, and hot cupboard and boiler being arranged between the ovens. The range measures 5 ft. 2 ins. by 2 ft. 2 ins. Four 8-in. boiling discs, rated at 1200 watts, and two 6-in. discs, rated at 800 watts, are provided on the hot plate all arranged for three-heat control. There is a hot cupboard between the top plate and oven, white enamel lined, an enamelled crown plate being provided under the grill, which is rated at 4½ kw. and measures 26 ins. by 11 ins. The hot cupboard between the ovens has no heating unit, but receives sufficient heat from the ovens and boiler to keep plates and food warm. The boiler holds two gallons, and is heated by a separate element, rated at 3000 watts, with single heat control. It will give three pints of boiling water in four minutes, starting all cold. If desired a low heat can be provided to keep the water at boiling point. Both ovens in the cooker measure 21 ins. by 14 ins. by 13 ins. Each oven is rated at 3000 watts, three-heat control being arranged for. The smallest double cooker will carry out all the cooking needed by a household of twenty-four persons, while the largest size will cater for sixty persons.

"Electroyl" Cookers. Messrs. Purcell & Nobbs of London are well known and have been long established as kitchen engineers, and since the advent of electric cooking, have specialised in the design of apparatus for domestic and restaurant use. I am able to give illustrations of two of the firm's cookers, one for small households and the other of higher grade for large residences. The small domestic cooker is made with a cast-iron frame with mild steel double-cased oven, and is suitable for a family of five to ten persons. The oven inside measures 23 ins. by 16 ins. by 16 ins., and is rated at 3000 watts with three-heat control. At full heat, therefore, the oven costs 3d. or 6 cents per hour to run, the lower heats being proportionately less. Above the oven is a hot plate with two 8-in. boiling discs taking 1200 watts, one 6-in. disc consuming 750 watts and a 1500-watt griller-toaster measuring 12 ins. by 9 ins. The hot closet between the oven and hot plate measures 16 ins. by 16 ins., and is useful for keeping

plates and food warm. The boiling discs are flush with the surface of the hot plate, and are intended for use with ordinary flat-bottomed utensils, three-heat control being provided in each case. No switches are mounted on the cooker, a separate control panel being provided for fixing to the wall. A better grade of cooker in cast iron is also made with the same equipment, a two-gallon copper water boiler with separate three-heat immer-



A Typical Domestic Cooking Equipment.

sion-type heating element being mounted on brackets at the side. The boiling discs, grill, and oven elements are easily detachable for replacement. The large Electroyl cooker is of steel throughout with double doors to the oven, the latter being air lagged, i.e., it has double sides, the intervening space having no packing or other heat insulation beyond that formed by air. In the air space is a system of flat copper water pipes to absorb any heat

All-steel "Electroyl" Cooker.

escaping from the oven, a temperature of 110° F. being readily obtained. The water may be further heated if required by an immersion element, a draw-off tap being provided under the hot plate, and an automatic expansion feed-water tank is usually recommended to ensure a constant supply. The range weighs only about half that of an ordinary cast-iron cooker. Provision is made for the renewal of elements, and all parts are accessible for cleaning, its capacity being equal to the needs of the largest family. A separate control panel with switches, fuses, and pilot light is provided.

There are three boiling discs flush with the top plate, and a large grill, the discs being rated at 1200 watts and the grill at 1800 watts. The oven elements consume 4200 watts at full heat, the lower heat taking about 2000 and 1000 watts respectively.

EXAMPLE OF WEEKLY COOKING OPERATIONS IN A SMALL FAMILY AND COSTS

I am able to give some interesting particulars of the practical cooking operations with the General Electrical Company's R. 1 Electric Cooker as in use in America.

The first series are heavier than those which would be used by the ordinary family, as a roast was included in five of the six days recorded. The dinners were served to 10 or 12 persons. The lighter menus are more representative of the cooker so used for an average family of 5 persons. These menus are given for six successive days.

The maximum peak load is approximately two-thirds of the connected load.

The operating cost with minimum consumption is approximately $2.00 per month with a 1d. or 2-cent rate. The amount of energy used would, of course, vary with each family and would be at a minimum when used by an experienced operator. For instance, a device such as the oven may be used to bake several articles in succession, thus saving the delay and expense of reheating. Practically all the water used with the above menus was heated in a cast aluminium tea-kettle on one of the stoves and is included in the total energy consumed. These tests show that excellent results can be obtained at a reasonable expense by the use of an electric cooker.

HEAVY DEMAND MENU—No. 1

	Amount.	Mins.	Watt-Hr.	Total Watt-Hr.
Breakfast:				
Pork Chops	1 lb., 2 oz.	21	355	
French Toast	6 Slices	5	86	
Coffee	3 pts.	22	169	610
Dinner:				
Roast Turkey	10½ lbs.	156	2388	
Cranberry Sauce	1 qt.	25	420	
Potatoes	3 lbs.	84	206	
Onions	2 lbs.	85	223	
Suet Pudding	15 ozs.	36	611	
Water	1 qt.	10	171	4019
Supper:				
Cold Roast Turkey				
Biscuits	....	44	582	
Tea	1 qt.	10	159	
Cranberry Sauce				
Pork Cake	....	...	....	741
Total	....	...	....	5370

5370 watt-hrs. equal 5.3 units costing just over 5d. or 10 cents.

MENU No. 1 FOR AVERAGE FAMILY

	Amount.	Mins.	Watt-Hr.	Total Watt-Hr.
Breakfast:				
Oatmeal	1½ pts.	44	153	
Dropped Eggs on Toast	5 eggs	6	209	
Toast	12 slices	13	133	
Coffee	1 qt.	20	162	657
Dinner:				
Pork Chops	8 medium	25	385	
Fried Apples	1¼ lbs.	13	197	
Boiled Potatoes	2 lbs.	77	193	
French Toast	10 half slices	10	171	
Sauce for French Toast	....	7	98	
Coffee	1 qt.	17	175	1219
Supper:				
Omelet	5 eggs	10	101	
Fried Potatoes	....	14	248	
Muffins	15	56	723	
Tea	1 qt.	14	266	
Preserves	....	...	....	1338
Total	....	...	....	3214

3214 watt-hrs. equal 3.2 units, costing just over 3d. or 6 cents.

MENU No. 2 FOR AVERAGE FAMILY

	Amount.	Mins.	Watt-Hr.	Total Watt-Hr.
BREAKFAST:				
Corn Flakes				
Fried Eggs	5 eggs	6	114	
Toast	8 slices	11	112	
Coffee	1 qt.	18	140	366
DINNER:				
Roast Beef	6 lbs.	135	1925	
Mashed Potatoes	2 lbs.	68	203	
Baked Macaroni	½ lb.	30	486	
Caramel Pudding	....	20	345	
Coffee	1 qt.	16	126	3085
SUPPER:				
Creamed Codfish	....	...	88	
Pop Overs	12	44	764	
Preserves				
Tea	1 qt.	10	178	1030
Total	....	...	....	4481

4481 watt-hrs. equal nearly 4½ units, costing 4½d. or 9 cents.

MENU No. 3 FOR AVERAGE FAMILY

	Amount.	Mins.	Watt-Hr.	Total Watt-Hr.
BREAKFAST:				
Oatmeal	1½ pts.	38	192	
Meat on Toast	....	5	90	
Toast	10 slices	15	162	
Coffee	1 qt.	18	137	581
DINNER:				
Soup	1 qt.	15	180	
Steak, broiled	3 lbs.	35	607	
Steamed Potatoes	2 lbs.	64	242	
Vegetable Salad				
Suet Pudding	10 portions	65	191	
Coffee	1 qt.	18	128	1348
SUPPER:				
Beef warmed up	....	6½	96	
Boiled Potatoes	2 lbs.	53	273	
Bread				
Tea	1 qt.	8	139	
Cake	1½ lbs.	54	436	934
Total	....	...	....	2875

2875 watt-hrs. equal nearly 3 units, costing 3d. or 6 cents.

MENU No. 4 FOR AVERAGE FAMILY

	Amount.	Mins.	Watt-Hr.	Total Watt-Hr.
BREAKFAST:				
Cornflakes				
Fried Bacon	½ lb. }	11	188	
Fried Eggs	5 eggs }			
Muffins	....	44	620	
Coffee	1 qt.	18½	140	948
DINNER:				
Lamb Chops	10	11	276	
Creamed Potatoes	2 lbs.	12	167	
Green Peas	2 cups	11	71	
Apple Pie	2 pies	60	768	
Coffee	1 qt.	18	142	1424
SUPPER:				
Baked Beans	2 cans	30	93	
Toast	10 slices	14½	155	
Sauce				
Tea	1 qt.	12½	212	
Cake	....	...	....	460
Total	....	...	....	2832

2832 watt-hrs. equal nearly 3 units, costing 3d. or 6 cents.

MENU No. 5 FOR AVERAGE FAMILY

	Amount.	Mins.	Watt-Hr.	Total Watt-Hr.
BREAKFAST:				
Oatmeal	½ pt.	41	189	
Hash	2 lbs.	15	210	
Toast	8 slices	11½	121	
Coffee	3 pts.	23	193	713
DINNER:				
Tomato Soup	1 qt.	35	38	
Fried Ham and Eggs	1½ lb. } 7 eggs }	25	363	
Mashed Potatoes	2 lbs.	80	241	
Turnips	2 lbs.	75	272	
Coffee Jelly				
Coffee	1 qt.	19	157	1071
SUPPER:				
Creamed Beef	½ lb.	14	157	
Fried Potatoes	....	13	225	
Toast	8 slices	13	140	
Tea	1 qt.	11	195	
Layer Cake	....	36	585	1302
Total	....	...	....	3086

3086 watt-hrs. equal just over 3 units, costing 3d. or 6 cents.

MENU No. 6 FOR AVERAGE FAMILY

	Amount.	Mins.	Watt-Hr.	Total Watt-Hr.
Breakfast:				
Cornflakes				
Fried Smelts	12 ozs.	19	353	
Toast	8 slices	13	136	
Coffee	1 qt.	18	149	618
Dinner:				
Boiled Halibut	3½ lbs.	53	726	
Egg Sauce	....	12	178	
Steamed Potatoes	2 lbs.	77	193	
Stewed Tomatoes	1 qt.	67	147	
Pie				
Coffee	1 qt.	18	149	1393
Supper:				
Scrambled Ham and Eggs	½ lb. ham, 5 eggs	8	136	
Cranberry Sauce	1 qt.	24	297	
Biscuits	1 pan	35	600	
Tea	1 qt.	10	159	
Layer Cake	....	...	....	1192
Total	....	...	....	3203

3203 watt-hrs. equal a little over 3 units, costing 3d. or 6 cents.

The consumption and the maximum load from both classes of menus per day were as follows:

	Heavy Demand Menu.		Average Demand Menu.	
	Kw.-Hr.	Max. Load.	Kw.-Hr.	Max. Load.
1st day	5.145	2.000	3.214	2.500
2nd "	5.296	2.200	4.481	2.200
3rd "	5.302	2.400	2.873	2.850
4th "	6.302	2.200	2.832	2.450
5th "	5.156	2.100	3.086	2.050
6th "	5.370	2.000	3.203	2.050
Avg. Kw.H. per day	5.540	.....	3.281	

The energy consumption will, therefore, probably be between 5.540 Kw.H. and 3.281 Kw.H.

	Kw.-Hr.
Minimum	3.3
Average	4.5
Maximum	5.6

Part of Electric Restaurant Kitchen Equipped by General Electric Co. of America.

Examples of Large Cooking Plant for Hotels, etc. For large residences, hotels and restaurants many types of electric cookers, grills, steamers and hot cupboards have been evolved, chiefly by English speaking makers. The cost of current in Great Britain is, generally, much lower for cooking and heating than that in America, with the result that hotel proprietors are finding it a paying proposition to replace gas and coal-heated apparatus by electric cookers, purely on the basis of running costs. I am able to show one or two typical designs of such apparatus which are in constant operation at restaurants, hotels and mansions in England, as well as to illustrate one or two installations which have been running in some cases for several years under the all-electric régime. I am also giving some of the best American practice—the Stanley Hotel and other large plants being extremely successful. In the early part of last year (1913), the Duke of Westminster gave a banquet to political friends, and his chef reported that the kitchen equipment at Grosvenor House was inadequate to deal with the exceptional requirements. Enquiries were set on foot, and it was made evident that nothing but electrical cooking apparatus could be installed in time. Messrs. Purcell & Nobbs of London were entrusted with the work and although they had only 2 days' notice, sufficient cookers, grills and other appliances were supplied and connected up to carry out the work. Everything worked so smoothly that the Duke, I believe, has since arranged for the entire electrification of his kitchen. This is only one of many recent instances which might be cited to show how rapidly electric cooking is superseding older methods in the houses of the aristocracy and in hotels and restaurants. Even in restaurants where the cooking is carried out at present mainly by gas or coal, electric grills, hot cupboards, Bain Maries and carving tables have been installed, and these are the forerunners of an entire change over to electrical operation.

"Falkirk" Electric Grill. Although it has for some time supplied the castings for electric cookers to manufacturers of the apparatus, the Falkirk Iron Company, well known for Heating and Cooking Apparatus, has not, until recently, made up electric cookers of its own, but, recognising that the future lies

" Falkirk" Restaurant Grill.

with electricity, it has lately laid itself out to develop this department, and has designed a range of electrically heated appliances for domestic and hotel use of which I am only able to show one example.

This is a self-contained electric grill, built up on high legs in cast iron with moulded and polished edges. It has exposed wire elements wound over strips of mica supported in a frame at the top, and protected from accidental contact or injury by a perforated grid. It is loaded to 4kw., and costs, therefore, 4d. or 8 cents to run per hour. It is capable of cooking a dozen chops or steaks at one time, or a similar number of portions of fish, and is intended for mansions or hotel work. The elements are divided into two halves, each controlled by a push-and-pull switch mounted below the grill in front. An ingenious lever arrangement at the side raises the grid on which the food is placed so that its relation to the heating element may be varied at will. A double grill on similar lines and batteries of grills are made for restaurant work.

Large " Electroyl " Toaster and Grill. My next illustration shows a large " Electroyl " grill toaster and hot cupboard for hotels and large houses. Its capacity is sufficient for 24 pieces of toast per hour, and for 12 chops or steaks. The heating elements are of exposed wire type, protected from mechanical

injury, and rated at 11 kw. with everything at full heat. Its running cost is thus 11d. or 22 cents per hour, with the grill, toaster and hot closets in operation. It is built up of cast iron

" Electroyl" Toaster, Grill, and Hot-cupboard for Restaurants.

with polished steel, and has 4 self-contained compartments, the topmost being used for plate and dish warming, the second for toasting, the third for grilling and the lowest for keeping food warm. Heat regulation is effected by a group of push-and-pull

switches mounted between the third and bottom compartments.

" Electroyl" Vegetable Steamer.

Vegetable Steamer. The electric steamer here shown is suitable for restaurant and mansion use, and is capable of steaming 80 lbs. of vegetables at one time, 5 galvanised steel trays being used to hold the articles being steamed. There is a boiler at the bottom, supplied by an automatic feed from a cistern at the side. The heating unit in the boiler is the Electroyl immersion type, rated at 5 kw. or 5000 watts, and costs 5d. or 10 cents per hour at full heat. Heat control is effected by a pair of switches mounted on the front. A draw-off cock is provided, and water connections for a constant supply from the main. The device is built up of cast iron, supported on a stand with legs and a shelf for holding vegetables before steaming.

Fish and Potato Fryer. Large fish and potato fryers are now in use in a number of restaurants. The apparatus is shown in the accompanying illustration, and is a handsome device, with closed-in base, faced with white tiles. Its heating elements are of the exposed-wire type, duly protected, and rated in all at 6 kw. or 6000 watts, involving at full heat a running cost of 6d. or 12 cents per hour. Heat regulation is effected by a pair of rotary indicating switches mounted above the grilling com-

partment in front. A flue is provided on top, not, of course, that electricity-operated devices require any ventilation, for they create no smell, and, since there is no flame or combustion, do not vitiate the air, but in order to carry away the vapour when frying fish and potatoes, this vapour forming whatever system of cooking is employed.

"Electroyl" Fish and Potato Fryer for Restaurant Use.

Benham & Sons Bread-baking Oven.

"Benham & Sons" Electric Bread-baking Oven. This type of oven was supplied to H.M. the King for the new Royal Yacht "Victoria and Albert." Its overall sizes are 51 ins. wide×27 ins. deep×6 ft. 8 ins. high.

The upper oven is used for Vienna bread and is specially constructed with arched top, sloping bottom, balanced shutter door, and a slight drip of water (easily controllable) for formation of steam when required. The lower oven is for ordinary bread. Both ovens are provided with special elements which give six variations of heat, and thermometers are fitted as shown.

Benham & Sons Bread and Pastry Oven.

"Benham & Sons" Electric Bread- and Pastry-baking Oven. The second type of oven shown was supplied to H.M.S. "Renown." Its overall dimensions are 4 ft. wide×25 ins. deep×3 ft. 4 ins. high.

Electric Baker's Oven and All Electric Bakery. One of the most useful applications of electricity is for heating bakers' ovens. Running costs are reduced, time and labour are saved, and what is of equal if not greater importance, a very material saving in floor space is effected. A well-known confectioner in London who needed greater capacity in his kitchen, found that it could not be secured without rebuilding, on account of the prohibitive cost of acquiring adjoining premises. The difficulty was solved, however, by installing electric pastry and bread ovens, the output being increased sixfold with the existing kitchen accommodation, thus avoiding any structural alterations, the

present coke-heated ovens being replaced by electric apparatus similar to the model here illustrated.

An American all-electric bakery with similar ovens is worked as follows:

Electric Oven for Bakeries.

The flour is unsacked into a bin in the cellar and elevated by an electric flour lifter and conveyor into the large hopper above the dough mixer, the hopper being suspended from a lever connected with a scale beam so that it can be weighed at any time. After the dough is mixed, it passes into rising tubs, and from the rising tubs into the dividing machine. With each revolution of the wheel of this machine, four loaves of any desired weight are punched out and dropped upon a delivery belt. An ingenious arrangement of small hoppers sifts flour into the dough at the proper intervals to avoid any tendency of the dough to stick. A minute after a loaf drops upon the belt it is delivered to the moulding machine, which kneads the loaves exactly as the old-fashioned baker did, turning them twice from end to end, then twice from the side, and finally rolling them around

the wheel at the bottom. The loaves then roll into a pan and are carried to the oven, all of these operations being performed by electric motive power, the electric current supplying the baking heat.

This particular oven works from twelve midnight until five the following afternoon, because it is used for pastry in the daytime.

Its capacity is 500 lbs. of bread per hour; its effective baking area is 42.5 square feet, and it takes 22 kw. when full on, costing, therefore, only 1/10 or 44 cents per hour to run. The floor space occupied is 18 square ft., as compared with the coke oven of a similar capacity, which occupied 60 square ft

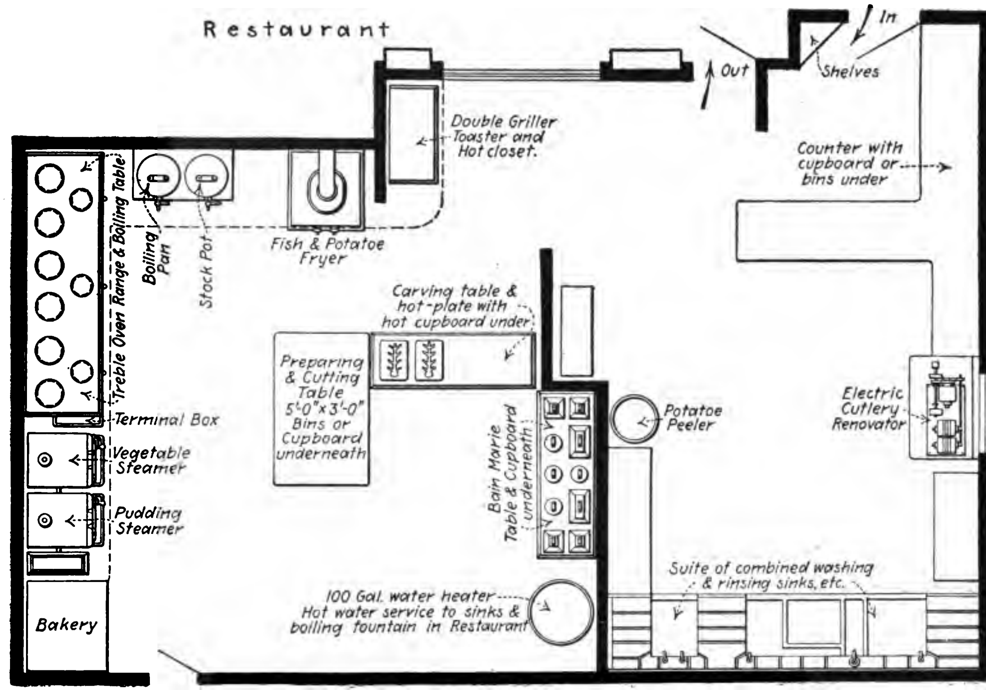
Benham & Sons Hot Closet and Serving Table.

"Benham & Sons" Electric Hot Closet and Serving Table. This has two compartments, each 2 ft. 10 ins. wide × 1 ft. 10 ins. deep × 12 ins. high inside. There is a bright top with sliding doors in front.

A very efficient hot cupboard and carving table made by the Brompton and Kensington Accessories Co., Ltd., London. Its total loading is 2000 watts, with 3-heat control.

Ferranti Stock Pot or Stew Pan.

Hotel Cooker by Simplex Co. of America.



PLAN OF AN "ALL ELECTRIC" KITCHEN

With Bakery, Grill, Serving, Preparing and Wash-up Room for a London Restaurant.

The Equipment comprises:—Bread and Pastry, Bakers' Oven, range of Roasting Ovens, with boiling table over, Vegetable Cooker, Pudding Cooker, Stock-pot, Boiling-pans, Fish and Potatoe Frier, Double Grill and Toaster (a rack and canopy running the whole length over them with motor and small exhaust fan), Carving and Serving Table, Baine Marie, Hot Cupboards, Water Heater, Scouring and Cleaning Sinks, Polishing and Cleaning Motors and Utensils.

The vegetable, preparing, cleaning and wash-up room being fitted with vegetable and fruit peelers, plate and dish washers, cutlery and plate-polishing tables, washing and rinsing sinks, cupboards, etc., etc.

EXAMPLES OF LARGE ELECTRIC KITCHENS

That the Electric method of Cooking and Heating are the most useful and efficient for houses and flats, where a supply of electricity can be obtained at 1d. per unit or less, has been fully demonstrated, and there are many instances where an *all-electric Installation* has been in practical use for a considerable time; that it is commercially efficient for large houses, mansions, hotels, restaurants is also fully demonstrated by the following few examples, particulars and illustrations of which I am able to give. These will also serve to show how rapidly electric cooking is being taken up in large establishments, English and American hotels and restaurants, etc. It would take too large a volume to describe adequately many of the large installations. The equipment and cost of working vary according to the class of establishment. In hotels and restaurants it has been easy to keep a record of costs. The consumption of electricity varies from .25 to 1 unit per person served per day and the average is about .35 unit. One kitchen serving 600 persons a day consumes 240 units or .4 unit per person per day; another quite a different class serving 350 fixed lunches per day consumes 140 units per day or also .4 unit per person served per day.

The B. & K. Restaurant. Everyone in London interested in Electric Cookery should pay a visit to The B. & K. Restaurant, Earl's Court Road, Kensington, a few yards from Earl's Court Station. It is indeed a revelation of cleanliness, simplicity and perfection. The whole surroundings are exceedingly artistic to begin with. Little separate tables are so cleverly arranged that one has only to say "Open Sesame," or in other words touch a switch, and your bread becomes toasted, your water boiled to make your own tea or coffee. Then a most delightful electrically cooked luncheon is served, and the great charm of it all is that visitors can go over the whole of the kitchen before luncheon, *and still retain a perfect appetite* for same, in fact,

one's appetite has increased after having come in contact with the exquisitely clean and sanitary culinary procedure.

I had the pleasure of lunching there with friends before its public opening. All were simply fascinated by the whole thing, and felt one could really eat in the kitchen itself, it was all so clean, so dainty, so free from any cooking smells.

Main Dining-room of the B. & K. Electric Restaurant.

Since then I am continually taking friends there and they are perfectly astounded at the results of "Cooking by Electricity." Even those who were utterly against my opinions have been converted to my way of thinking as a result of practical experience and increased familiarity with electrically-cooked meals. The proof of the pudding is in the eating, and it only needs a visit to Earl's Court Road to convince the most sceptical that electric cooking is the ideal method, and that it is neither costly nor unreliable.

My readers will judge of themselves by the accompanying illustrations as to the appearance of the restaurant and its electrical equipment, but a far more convincing test is to visit the place oneself and enjoy an electrically-cooked luncheon or dinner.

The following details will interest those who want to know the class of electric cooking apparatus needed for large restaurant use.

Part of the B. & K. Restaurant Kitchen.

The main kitchen is fitted with a large cooking suite 28 ft. in length by 8 ft. high, which is, I believe, the largest electric cooker yet built. Its maximum loading is 70 kw., and there are independent self-contained vessels such as turbot kettles, stock pot, ham boilers, etc., having an additional capacity of 20 kw. with connections on the hot plate. The heat control is effected by 58 pull and push switches mounted in the framework below the hot plate at a convenient height. There are nine ovens of various sizes in the lower portion, loaded to suit the work for which they

are intended. At the extreme right there are two steamers for vegetables, fish, puddings, etc., two large ovens adjoining being used for baking the bread and rolls required in the restaurant. A large fish fryer and a grill and toaster are fitted at the left-hand end. On the main plate are twelve boiling rings of various sizes and loadings, these being mounted flush with the hot-plate surface, so that a large number of flat-bottomed utensils can be heated simultaneously, simmering, slow or rapid boiling being effected according to the position occupied by the vessel on the plate. Along the top of the range is a row of indicating pilot lamps connected to the various circuits controlled by the switches below, each lamp being covered by a glass with the circuit and degree of heat clearly marked upon it. Hot cupboards for silver, with sliding doors, are placed below the indicating lamps. Apart from the large cooking suite, the kitchen equipment comprises a bain-marie, fish-kettle, stock-pot, egg-boilers, electrically-driven meat-choppers and coffee-grinder, and an electrically-heated and driven coffee-roaster. Hot water for the kitchen and adjoining scullery is furnished by a 100-gallon "Cooper" water-heater.

The grill in the main restaurant is double, and comprises also a carving table with hot cupboards below. Throughout the restaurant hot plates are fitted, so that dishes may be served steaming hot and not luke-warm, as is so often the case in restaurant practice. Hot plates are fitted even in the food lifts, so that no cooling effect takes place during the passage from one floor to another. The lifts themselves are electrically driven. At the back of the main dining-room is the servery, with a range of electrically heated urns for supplying tea, coffee, etc. In the basement is a mess-room, where the restaurant staff have their meals cooked and served. Electricity is, of course, used here also, and the outfit is shown in operation to interested visitors.

On the first floor is a model kitchen, fitted with a domestic pattern electric cooking range and accessories. Thus, visitors who desire a small domestic equipment can see what appearance their kitchen would have when an electric cooker was installed, and can be given a close estimate of the initial and running costs from actual experience. Those whose kitchens would need a

more comprehensive outfit would be taken to the staff kitchen, which is correspondingly larger, while the equipment in the main kitchen appeals to those interested in restaurant and hotel practice, although a section of the main cooking suite would form a suitable unit for a large private residence or small boarding house.

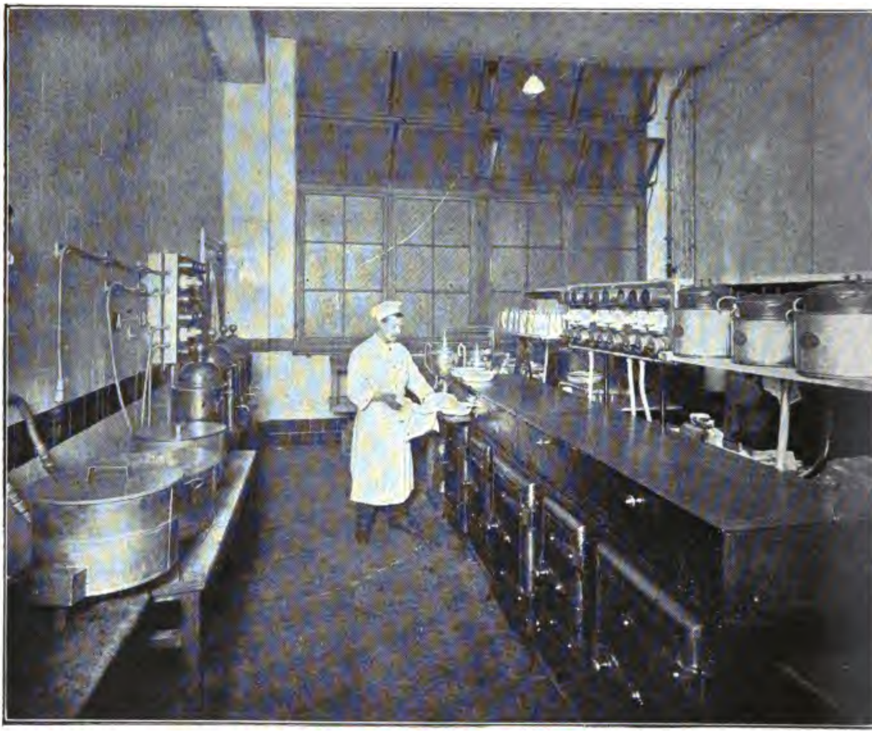
For storing meat there is a large cold chamber cooled by an electrically driven refrigerating plant, which also furnishes the ice needed in the restaurant. A perfect system of ventilation has been installed, the arrangements comprising ducts by which air is drawn from the outside, cooled in summer and warmed in winter, and delivered to the restaurant through gratings, being afterwards exhausted by means of motor-driven fans in the roof. An even temperature is thus secured throughout the building, free from draught.

The total loading of the equipment is approximately 140 kw. In practice, however, the maximum usually attained is only one-third of the total capacity of the apparatus. The actual consumption of electricity for all purposes approximates to a little over one unit per person served.

All the departments are connected by telephones, and every table has a press button, which instead of ringing a bell, lights up a signal lamp in the servery, this remaining alight until the call had been answered. Electric clocks are provided at convenient points, while dust and dirt are removed by electric vacuum cleaners. Careful thought has been given to the lighting problem, and several methods are in use, direct, semi-indirect and concealed. While dinner is being served, the lighting of the main room is effected entirely by candle standards on the table, daintily shaded, giving a soft and warm appearance.

Seating capacity is provided for about 100 diners at one time. No overcrowding is permitted, and the guests may be sure of enjoying well-cooked meals in comfort, with quick service. The main restaurant is panelled in dark oak, with arched ceiling decorated with frescoes. It has 8 tables, and behind, under the balcony, is a large grill used for cooking operations that can be watched by visitors. The balcony is reached by a staircase at the side, and here space is found for about 7 tables. This apartment overlooks the main restaurant, and a very charming spot

it is for lunch and a quiet chat. A glass door opening from the balcony gives access to the principal kitchen, which is open at all times for inspection by visitors. On the ground floor is a cosy tea room, which has become exceedingly popular for social tea parties in the afternoon.



Part of Debenham & Freebody's Kitchen.

Kitchen of Messrs. Debenham and Freebody. This installation is particularly interesting, since it was one of the first put down for carrying out the cooking for the employees of a large drapery warehouse in London, meals being supplied daily for about 500 persons. The decision to adopt electricity was not due to sentiment in any way, but purely to considerations of economy in use, to convenience, cleanliness, and to the small amount of floor space needed to accommodate the equipment.

Meals for the 500 employees are prepared every day, the catering being in the hands of a firm which specialises in feeding the staffs of large establishments, and has found by prolonged experience that electricity offers the cheapest and most reliable means of carrying out the work. Starting with a decided prejudice against electrical operation, the manager has become an enthusiastic convert to it, as a result of his own experience under commercial conditions, and no kitchen which his firm is asked to equip will in future contain anything but electrically-heated apparatus.

Some of the Electric Cooking Apparatus at Torquay Pavilion.

Electric Restaurant at the Torquay Pavilion. In connection with the Torquay Pavilion is an all-electric restaurant, which was opened on August 19th, 1912. It is the property of the Corporation and intended to provide the residents as well as the numerous winter and summer visitors with an up-to-date resort where they may enjoy high-class orchestral and vocal concerts, and at the same time be able to partake of lunches, teas, dinners, and suppers under the same roof.

The premises throughout are electrically lighted, and certain portions are electrically heated. The whole of the cooking and some of the water boiling is also electrical.

The restaurant is provided with a kitchen and servery for ground-floor requirements, and a second servery for light refreshments on the roof, which commands a fine view of Torbay.

The kitchen outfit includes 2 steel ranges, loaded to 6 kw.

Torquay Pavilion. Carving Table and Hot Cupboard.

Torquay Pavilion. Grill and Urns for Coffee and Tea.

each, a steel meat and fish grill taking 5 kw.; 9 hot plates with loadings varying between 800 and 2500 watts; one hot cupboard and water-bath carving table; a fish-fryer taking 6 kw.; an electrically-heated steamer for potatoes and fish; five 24-pint and two 6-pint stewpans; a 10-gallon stock pot; large fish kettle; small fish fryer; bain marie on hot plate; and an electric knife cleaner. In the ground floor servery is a 6-kw. toaster; a 2-gallon

Torquay Pavilion. Electric Cooker, Grill and Toaster.

milk urn; two 3-gallon percolators; two 2-gallon water and coffee urns; an egg boiler and poacher. The upper servery has an identical equipment. With everything full on, the total loading is about 150 kw., or 150 units per hour, the usual working load being about one-third of the maximum. Most of the apparatus was supplied by Messrs. Purcell & Nobbs, of London. The upper and lower serveries are connected by an electric food lift, electrically heated to keep the meals hot while in transit. During

Kitchen of Messrs. Harvey Nichols & Co., Kensington, London.

the first 30 working days 17,000 persons were served, the consumption of current working out at .276 of a unit per person served.

The Polytechnic Restaurant. The electric restaurant in connection with the Regent Street (London) Polytechnic can fairly claim to be the first all-electric permanent restaurant in England, and has now been running with unqualified success since the summer of 1911. It provides meals for the students and members of the Institute and their friends, the equipment including 3 ovens and 2 hot cupboards in one range, with a long hot cupboard running the entire length of the range. The ovens are 25″ high, 22″ wide and 20″ deep, one hot cupboard measuring $22\frac{1}{2}''$ high by $12\frac{1}{4}''$ wide and $20\frac{3}{4}''$ deep. The loading of each oven is 7.5 kw., and this takes $7\frac{3}{4}$ units per hour, the elements being arranged in three equal circuits, with adequate heat regula-

tion by indicating turn switches mounted on wall panels at the back. There is also a range of 6 hot plates, of various sizes and with different loadings; a grill taking 4 units per hour; 2 hot cupboards with small well and carving tables; a large and a small fish fryer; an 8-gallon stock-pot; four 4-gallon copper urns; two 12-gallon cast-iron boiling pans; three smaller pans; steamers, fish kettles, and a water bath. There is also a hot plate on one counter for keeping cooked food hot while being served. The two illustrations will give a good idea of the electrical equipment and the method of connection and heat regulation. When everything is in operation at full heat, the loading is 85 units. Most, if not all, the equipment was supplied by The Jackson Electric Stove Company, of London.

The "Tricity House."

"Tricity House," London. The first all-electric restaurant available to the general public to be opened in London was "The Tricity House," in Oxford Street. As its name implies, the whole of the equipment consists of "Tricity" cookers and heaters, supplied by the British Electric Transformer Co., Ltd., of Hayes, Middlesex.

As the accompanying photograph shows, "Tricity House" presents a striking appearance alike from the outside and within, the style being old-world in character, with oak beams and panelling, plaster walls, oak tables, and straight-back chairs, the lighting arrangements harmonising with the decorations and consisting for the most part of Dutch design candle brackets, pendants and table standards. The "Tricity" ideal of bright polished surfaces is realised throughout, the cooking equipment, canopies surmounting the ranges, and every utensil employed being as bright and clean as in a showroom, although in active service all day long.

Since the first hour it opened its success from a commercial point of view was assured, and nearly 20,000 customers were served during the first three months—the average number of meals provided daily being about 420. Prices are by no means high, and customers can be sure of well-cooked wholesome food served in a dainty manner, the absence of gas fumes or oppressive atmosphere being welcome features.

There is accommodation for a large number of customers on the ground floor and in the West Room, a further number finding pleasant quarters in the East Room on the first floor. The kitchen —a miniature apartment measuring only 12 feet by 15 feet— is situated at the top of the building, communication with the other floors being secured by two electric lifts—one for food and the other for passengers.

The equipment in the kitchen comprises a grill, with four 1000-watt "Tricity" extension plates, and a similar number of discs above, so that grilling can be proceeded with on both sides at once. These top plates are adjustable as to height and can swing through a wide angle, thus permitting of just the degree of cooking desired by the customer for whom the dish is being prepared. A hot cupboard for plate warming is fitted with two 800-watt extension units. Deep fat frying is carried out in a special vessel heated by a couple of 1250-watt extension units.

There are fourteen extension plates in the kitchen, each rated at 900 watts, these being used for vegetables or with any flat-bottomed vessel.

For roasting, two double ovens of polished tin, each measuring

19″×28″×16″ are installed, the ovens being heated by four extension plates loaded to 900 watts. There is also a single oven heated by two extensions.

Hot water for washing up is provided by a coke stove in the basement and by an 8-gallon Tricity urn in the kitchen. All the units in the kitchen are interchangeable. Each hot plate has a separate control panel with tumbler switch, dial fuse, socket for 3-pin plug, and red indicating lamp, and is earthed through the metallic tubing.

In the East Room on the first floor there are a double oven and two single cookers for heating water urns or for toasting. The oven is used in the morning for cakes and pastry, and the plates later on in the day for keeping warm soup and other articles.

Behind the demonstration counter on the ground floor are three ovens, with extension plates; three single cookers for urns, etc., and two extension discs for keeping soup warm; a 3-gallon and 2-gallon urn for coffee and tea making being used on the plates later on in the day for keeping warm soup and other articles. grilling, toasting, etc.

The equipment in the West Room comprises two single ovens heated by extension plates; a single cooker with two extensions for heating soup and in the afternoon for heating urns for tea and coffee making or for toasting.

There are five convectors on each floor rated at 2.1 kw., thus taking 2.1 units per hour, and these maintain an even temperature throughout the day, three-heat control being provided.

The food lift is operated by a $1\frac{1}{2}$-hp. B.T.H. motor and the passenger lift by a similar motor of 6 h.p. The total loading with everything in full operation is 120 units, the average working being about 40 units per hour.

Middlesex Guildhall Electric Kitchen. An interesting example of installations of electric cooking apparatus in public buildings in London is the electric kitchen attached to the new Middlesex Guildhall, Broad Sanctuary, Westminster.

This kitchen is at the top of the building, and is equipped exclusively with "Tricity" Apparatus, comprising a large grill heated by 4 extension cookers, each taking 850 watts; a hot-closet separately heated, to take 200 plates or dishes, two boiling

Part of Middlesex Guildhall Electric Kitchen.

discs over the closet; a fish and potato fryer heated by two 850 watt discs, 4 ovens measuring 19″×16″×14″ with top and bottom heats; a large carving table and hot cupboard with two detachable copper carving wells heated by two extension cookers under a water tank.

There are also two 6-pot bains marie, several large steamers, vegetable boilers, urns, ham boilers and other independent appliances, the total loading of the entire equipment being 29.5 h.w. or 29½ units per hour. The outstanding feature of this kitchen is that the whole of the heating effect is produced by independent extension cookers or boiling discs of "Tricity" pattern. Each cooker is controlled from a separate switch and fuse panel, with an indicating pilot lamp that glows bright at "full" heat and *dull* at "low" heat, thus enabling the cook to see at a glance, not only what cookers are in operation, but at what heat they are running. As every cooker is independent, rénewals can be cheaply and quickly effected, while extensions to the outfit can be made at any time by multiplication of the units with which it is built up. At present the capacity of the equipment is sufficient for 50 to 100 persons, meals being prepared for the Judges and for the office staff.

AN "ALL ELECTRIC HOTEL"

A Large Hotel Electric Kitchen. One of the largest installations of electric cooking apparatus in the United States has been supplied to the Stanley Hotel, Estes Park, Colorado by the General Electric Co., Schenectady, N. Y. Cooking is there carried out daily by electrical means for upwards of 300 persons. The General Electric Co. has specialised in hotel equipments, and has perfected a complete line of apparatus for restaurant and hotel service, all the heating elements employed being formed of Calorite metal, which is used exclusively by the Company, and can be run indefinitely at high temperatures without risk of oxidation or chemical change.

The apparatus installed at the Stanley Hotel comprises sectional ranges, radiant grills, bakers' ovens, large plate warmers, hot cupboards, toasters, stock pots, hot tables with carving wells, bain maries, hot plates, cereal cookers, and many accessories. Each sectional range consists of two roasting ovens, two radiant type grills or broilers, and a top cooking surface measuring 24″×36″, divided into 8 sections 9″×12″, each being controlled independently by switches mounted on a fuse and switch panel at the back. The ovens measure 28″ deep by 18″ wide and 16″ high internally. The entire range is built up and heavy sheet iron rivetted to an angle-iron frame, the ovens having double walls, with the internal space filled with heat-insulating material to reduce loss of heat by radiation.

For restaurant and hotel service, the electric grill offers many advantages over the charcoal, coal or gas forms. In view of overpowering heat and fumes from such forms of grill, it has been the practice to give a higher rate of pay to the chef whose duty was to operate them, but with electric grills, this is not necessary, since there is little external heat and no fumes or smoke produced. The grills for restaurant use made by the General Electric Co. are constructed in sections, so that one or two can be used with-

out heating up the whole apparatus. This effects economy in working costs, and permits of small orders being filled at a profit.

The baking and roasting ovens are so arranged that the top and bottom heating units are controlled independently; thus permitting of close temperature regulation. Each unit is designed for 3-heat control by switches mounted on a wall panel, the high heat being used to bring the oven up to a cooking temperature very rapidly, and the lower heats to carry on the cooking process

Steam Boiler and Circulation Water Heater in Laundry of Stanley Hotel, Estes Park (Colo.) Where Electricity is the Only Source of Heat.

itself. A roasting oven, measuring 16″×22″×24″, will cook a 35-lb. joint of beef in about 4 hours, and cook it to perfection, without waste from shrinkage, the whole of the meat being done to a turn. The baking ovens for bread are made with one or two compartments so that a larger or smaller quantity of bread or pastry can be baked economically. The larger oven installed at the Stanley Hotel has a capacity of 100 one-pound loaves of bread at a single baking, the time needed for the operation being 40 minutes. Each compartment of the oven measures 18″ high×45″ wide and 32″ deep.

Large toasters with incandescent heating units are also in use. These toast both sides of the bread simultaneously, six pieces of toast being prepared at one time, the toasting taking one minute when the device is hot.

The stock and vegetable cookers are of sheet copper with the heating elements mounted in the base, and arranged for 3-heat control. Several sizes are in service, the capacities ranging from 5 to 20 gallons. Automatic egg boilers are useful in hotels with a brisk restaurant trade and the General Electric Co. has supplied many for the purpose, while tea and coffee urns, electrically heated, are a great advance upon those heated by gas rings. The cereal cookers installed have a capacity of 2 gallons and are built up of sheet copper with tinned internal surface. The cereal retainer is vitrified stoneware, and the heating elements are mounted below the water vessel, which is provided with a draw-off cock. Electrically heated serving tables replace those formerly heated by coal or gas, and are fitted with bain-marie pans and carving wells with hinged covers to keep the joints hot.

Among the accessories installed should be mentioned cake griddles, food-warmers, frying kettles, hot plates, coffee percolators, irons for use in the hotel laundry and many other electrically operated devices which save both time and trouble and make the lot of the kitchen staff much easier and more pleasant than is possible in a gas-heated atmosphere. The whole of the laundry work including the steam and hot-water heating is done by electricity.

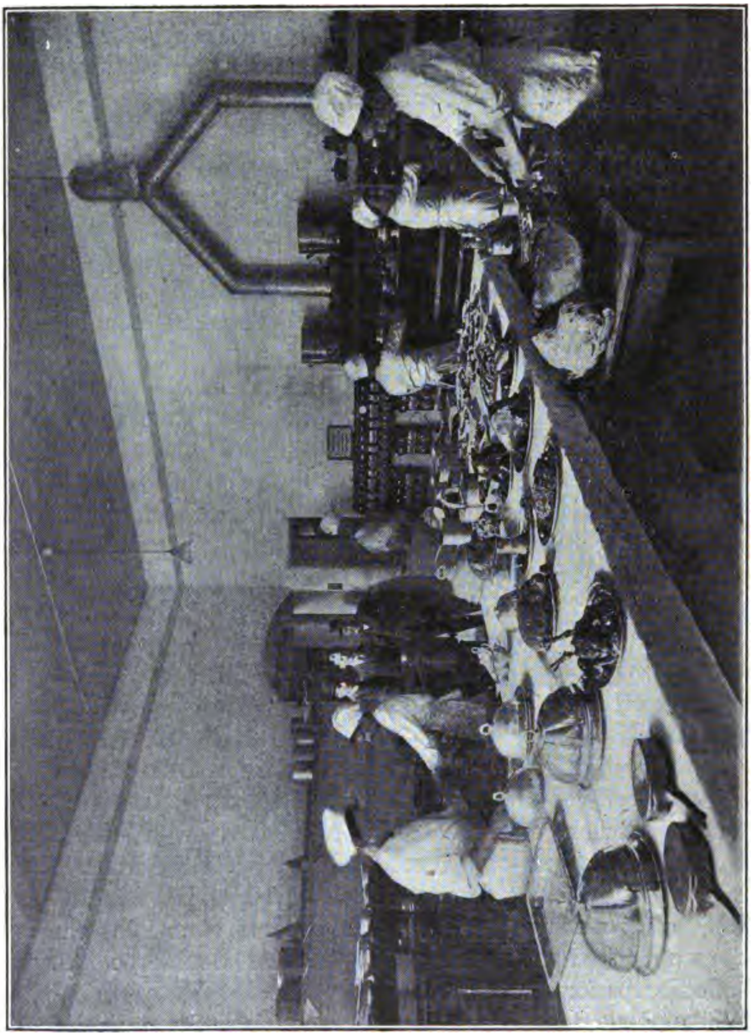
The Old Ship Hotel, Brighton, England. One of the most famous hotels in England is the Old Ship at Brighton, which was established in the time of the Georges, and was one of the best known coaching houses on the South Coast. It has always been celebrated for its excellent cooking, and many are the famous men who have stayed beneath its hospitable roof. Although old in years, the Old Ship has moved with the times, and when the coaching days were superseded by the age of the automobile, a large garage was added to the establishment, and this has lately been extended to cope with the ever-growing demand for accommodation. Special facilities have been lately provided for electric vehicles, and a complete charging plant for their

batteries added to the equipment. This will be specially appreciated by owners of electromobiles who run down to Brighton from London, a favorite trip of 50 miles, over the best-known road in the South of England. In another respect the Old Ship acknowledges the trend of progress, for it has quite recently abandoned its old gas and coal-heated kitchen, and has built an entirely new kitchen, equipped exclusively with electric cooking apparatus, which is doing the whole of the work of the hotel including Banquets. It is a frequent thing for 250 luncheons or dinners to be served during the day, and these are now prepared entirely by electricity, to the advantage of the guests and of the hotel staff, the latter working under hygienic conditions, impossible under the former régime.

The equipment was installed by the Jackson Electric Stove Co., Ltd., of London, and comprises a range of four ovens, each measuring $24'' \times 20\frac{1}{2}'' \times 20\frac{1}{2}''$ inside, with hot cupboards above, heated by separate elements. Each oven is loaded to 5 kw. at full heat and the hot cupboards to 2 kw. the total load of the suite being therefore 24 kw. involving a consumption at full heat of 24 units per hour. There is also a 7-kw. grill, measuring $36'' \times 12''$, with hot cupboard above heated by separate elements rated at 1000 watts. A fish fryer alongside has 2 oval pans measuring $18'' \times 12''$ rated at $2\frac{1}{2}$ kw. at full heat. Among the other apparatus is a large hot plate fitted with four 12″ boiling discs, each taking 2.5 kw. at full heat. There are also a couple of large vegetable steamers loaded to 5 kw. apiece, and several self-contained utensils, the loading at full heat of the entire kitchen outfit being about 60 kw. or 60 units per hour. In practice, so high a load is never actually taken, the average maximum being about half this figure.

Heat control for the apparatus is effected at switch, panels on the wall, fitted with rotary Hart switches, double pole fuses and pilot lamps for each circuit.

When gas and coal were used for cooking, the annual fuel bills were, I believe, somewhere about £150 and £350 respectively, but with electrical operation the current bill is unlikely to exceed £200, judging by the results of the first few months' consumption. Current is supplied from the Brighton Corporation direct current



Kitchen of Old Ship Hotel, Brighton, Sussex, England.

mains at 230 volts. My illustration shows the kitchen with its beautifully clean equipment and white glazed walls, the large oven suite being on the left, and the fish fryer and grill at the back, the control panel being on the left of the fish fryer.

Electric Cooking at the Empire Hospital, Westminster. London has always been famed for its excellent hospital system, and rightly so, for no City in the world has such magnificent institutions for the gratuitous relief of suffering; all the public hospitals being supported entirely by voluntary contributions.

Carving Table, Hot Cupboard and Large Steamers in Electric Kitchen of Empire Hospital, London.

Their equipment is always maintained at a high level, and every advance in science is taken advantage of to increase efficiency. It is only natural that electricity should play a prominent part in the working of a modern hospital, and the surgeon would be hard put to it if he were to be deprived of its assistance, to say nothing of the increased suffering on the part of patients.

London's latest hospital which was opened in December, 1913, is the Empire, situated in Rochester Row, Westminster, and its electrical equipment is particularly interesting and complete. In the operating theatre, laboratories and surgeries,

electrically-heated sterilisers and electro-therapeutic appliances are widely used. They have light and heat bathrooms, X-ray room and other electrical appliances for medical treatment, while the kitchen arrangements are entirely electrical. Since the object of my book is mainly to give information on the cooking, and heating and domestic side of electrical science, I will confine my notes to a brief summary of the kitchen equipment. This has been installed by the Jackson Electric Stove Co., Ltd., of London, and comprises a double cooker, with ovens

Double Cooker with Control Panel in Empire Hospital Electric Kitchen.

measuring $25'' \times 20\frac{1}{2}'' \times 20\frac{1}{2}''$, under a hot-plate containing four 10″ and two 8″ boiling discs, with a grill measuring $26'' \times 11''$. Each oven takes 4.5 kw. at full heat, with 3-heat regulation, the larger boiling discs being rated at 1.7 kw. and the smaller at 1.2 kw., the grill taking 3 kw. in two equal sections. There are two 6-gallon polished copper boiling pans with steamers, and loaded to 3 kw. at full heat, and having 7 heat-regulators; a large fish and potato fryer rated at 2.5 kw.; a 10-gallon copper stock-pot; a roasting oven taking 5.5 kw. and measuring $23'' \times 17'' \times 17''$; a large hot cupboard; two egg poachers to a capacity of 6 eggs

apiece, and two egg boilers capable of taking a dozen eggs at one time. Both the last-named devices take from 1000 to 1500 watts at full heat, provision being made for 3-heat control.

The hot cupboard measures overall 6′×2′4″×2′9″ high, and has a cast-iron top, containing 3 serving wells and a bain marie. The hot cupboard is loaded to 3 kw. and has 3-heat control, the carving table takes 1000 watts, and the bain marie 2.5 kw. with two lower heats.

The whole of the cooking for in-patients and staff is carried out electrically, the equipment having a total loading at full heat of 49.7 kw. This figure, of course, is never reached in practice, since all the apparatus is never in use at full heat at the same time. The average working is rated at 18 kw. The kitchen can deal with meals for upwards of 100 persons.

Pier Restaurant, Cape Town. Another interesting installation is that recently supplied by the Brompton and Kensington Accessories Co., Earl's Court Road, London, S.W., to the Corporation of Cape Town for the restaurant on the pier. The apparatus comprises a double cooker with grill and hot plate, carving table and hot cupboard, water boiler with circulating pipes, grill and toaster and a number of self-contained appliances. The cooking range consists of two standard B. and K. model C ovens, loaded at full heat to 2 kw. each. Above the ovens is a boiling and grilling table measuring 5′6″×2′4″, containing two 10″, three 8″ and three 6″ boiling discs, a grill between the ovens and a 3-pot bain marie. All the boiling discs are detachable and the elements can be easily removed, should they fail at any time. Over the suite is a control panel with Dumond H turn switches for heat regulation, double pole fuses for every circuit and indicating pilot lamps glowing with different degrees of brilliance according to the loading on the circuits with which they are connected. The loading of the range, at full heat is 14 kw. The carving table measures 3′8″×2′ and is fitted with two carving dishes loaded to 2 kw. at full heat. Air, heated electrically, is used for this table instead of the more usual water system. Hot water is provided by a 7 kw. Belenus boiler, which has a wide range of heat control according to the quantity and temperature of the water required.

Among the smaller apparatus is a separate grill and toaster, rated at 2.5 kw.; a 3-gallon coffee boiler; $1\frac{1}{2}$-gallon steamer and two 3-gallon hot water urns.

The equipment is arranged for operation on a two-phase Cape Town network, and is balanced accordingly, the total loading at full heat being 33 kw.

Romano's Restaurant, London, England.

Romano's Restaurant, London. This is one of the best known of the first-class restaurants on the Strand, and West Central District of London. It has long been noted for its most excellent cooking and its delightful grill service. The first installment of its electric equipment was completed a few months ago, and the working so far has exceeded expectations; it has not only given the most entire satisfaction to the guests, the management and the staff but has also proved a considerable saving in cost of working. The equipment in the grill room has replaced the gas and coke heated oven, grill, hot cubpoard and toaster and is operated in full view of the customers. It is similar in appearance and make to that shown in the first

illustration of the B. & K. Restaurant and although the capacity of the electric apparatus is at least 50 per cent greater than that of the gas and coke suite room sufficient for 2 additional tables seating 8 more customers has also been obtained by the change.

The suite comprises two combined 5.5 kw. grillers and toasters; a row of hot closets at the top, for food and plate warming, roasting and baking ovens and a large hot cupboard. The combined griller and toasters are fitted with rise-and-fall gridirons operated by hand levers at the right and left giving adjustment in $\frac{1}{4}''$ steps to the full height of the compartment. Porcelain drip catches are provided to lead away the fat and gravey out of the line of heat to a drawer pan underneath. The dripping thus saved is an item of considerable importance amounting to about 140 lbs. per month of 24 working days or a saving of 70/- per month at least.

The hot-closets being above the grills are heated indirectly by the waste heat through the ventilating ducts from the grills, oven and hot-table and also by an additional 1000 watt element.

Under the right-hand grill is the roasting and baking oven rated at 4.5 kw. with 2 lower heats. On the left is a hot cupboard used for plate warming rated at 2.5 kw.

There is also a nickel-plated bain marie with the necessary utensils rated at 1.5 kw. During the initial period of 55 days the current consumption was 1861 units which at the local rate of 1d. per unit cost £7–5–1. This included 18 units used for testing purposes when the apparatus was being installed. With the gas and coke heated equipment previously employed the cost of fuel averaged 4/- per day or for the period of 55 days £11.0.0 so that on the score of fuel costs alone there is a saving of nearly 1/8 per day or 40/- per month which with the dripping saved equals 110/- or £5–10–0 in favour of electric operation apart from the important consideration of simplicity, reliability, cleanliness, absence of smell and fumes, and greater comfort to the customers and cooks. The restaurant supplies upwards of 250 meals every day and has had as many as 500 customers in one day, so that its conversion to electric cooking is an event of considerable significance as an indication of the strides being made in commercial electric cooking in England.

Part of Electric Kitchen, Bank of England, London.

Electric Cooking at the Bank of England. I am able to give a view of part of one of the Electric Kitchens at the Bank of England which is considered one of the most important Electric Installations in the city of London. The total equipment will provide for the whole staff and supply upwards of 2,000 meals daily. All are most satisfied with the benefits derived from the first Electric Installation and the chef has stated that the cooking is far superior in every way by the electricity method to what it was with coal and gas.

The view given shows double roasting oven loaded to 6 kw., boiling discs and self-contained apparatus of 12.5 kw. Baking oven of 6 kw. Toasters, grills and salamanders, electric potatoe steamers, pudding steamers, fish kettles, baker's plates, stock pots, fish fryers, etc., etc., totalling 70 kw. Messrs. Crompton & Co. were responsible for this and Romano's installations.

ELECTRIC HEATING OF WATER

There are a number of Electric *Water Heaters* on the market, from the small one heating a little shaving water to the electric water heater which is fitted in the kitchen for the supply of hot water throughout the house, and the bath water heater. The supply of hot water by Electricity has been considered the most difficult part of the domestic problem, but electrical engineers have risen to the occasion and found means of giving a " Hot Water Supply " for all domestic purposes on lines of efficiency that will compare most favourably with any other system. In some cases, such as the all-electric houses, Hotels and Restaurants, where a *large supply* of hot water is required, and at the same time some suitable means to get rid of the house refuse, a small self-contained boiler can be advantageously employed to burn up the refuse and keep a constant quantity of water always heated to a temperature of 100 or 120° and circulating through the distributing pipes. From these pipes a connection can be made to the Electric Water Heaters, and if hot or boiling water is required, an interlocked tap and switch are turned giving an immediate supply. In many city houses and flats a continuous supply of hot water is provided night and day, and can be drawn for boiling purposes, but in small towns and other districts the hot water has to be provided by each separate householder, and such will ask, if the coal range and the gas cooker be displaced by electrical apparatus, how then can a supply of hot water be maintained for the bath, for washing and for the many domestic operations for which hot water is needed? For small or moderate quantities of hot water, electricity at ½d. or 1d. per unit is by no means expensive, and will compare most favourably with coal or gas, its cleanliness, simplicity, reliability, and freedom from danger being advantages

which cannot be secured by any other means. There are several systems on the market for dealing with the domestic hot-water problem, and these are described in the following pages. My readers will be able to judge for themselves which method would best suit their individual requirements, which are alike in no two cases. In one household hot baths are required every day, and much hot water is expected for cleaning and washing up. In another establishment hot baths are the exception, and hot water is only required for kitchen purposes. In almost every case, however, the need is for an ample supply any moment the demand may be made, and this condition can be met with certainty by electrical heating. In one system referred to on a later page, the existing hot-water pipes are made use of, and the electric boiler merely takes the place of the boiler in the coal range or the gas circulating boiler. It is possible so to fix the electric boiler that it may be used in conjunction with the existing coal or gas-heated boiler, or separately. In another system no hot water is stored at all, but the electrical energy is employed slowly to " store up " heat, which in turn heats the water instantaneously when it is passed through. This system does not permit of the use of the circulating pipes in the house, the heater being placed in the bathroom or kitchen where the hot water is usually required.

A further system stores up in a tank, well lagged with non-conducting material, a small quantity of very hot water, ready for immediate use, a further supply being available very quickly by means of the heating element attached inside. There are also a number of systems which heat water very quickly or instantaneously, but do not store any water, and only use energy when the current is switched on. These are very useful for houses where small quantities of hot water for tea-making or washing-up are needed at irregular intervals.

In addition to these devices, there are many designs of electric water heaters for dealing with large or small quantities, the apparatus being self-contained, and equipped with heating elements which raise the temperature more or less slowly. Such heaters are useful where a large quantity of water is required, but is not needed quickly.

For the heating of water and other liquids it is necessary to consider the efficiency of the system to be employed.

If 1 penny or 2 cents buys	7 lbs. of house coal, having according to Count Rumford........	45,612 ther. units
	27.8 cubic ft. of gas (at 3/— per 1000) having..................	13,476 " "
	1 unit of Electricity having......	3,412 " "

What is the efficiency?

Coal burned scientifically under a first-class water-tube boiler with every modern refinement may give an efficiency up to 60 or 70%. Used, however, in a domestic kitchener to heat a small kettle, its efficiency is unlikely to reach 10%, or a useful 4561 thermal units in 7 lbs. of fuel. Gas used under a kettle on on a gas cooker has an efficiency of less than 30%, or a useful 4042 T. U. in 27.8 cu. ft. The low efficiency is due to losses by conduction through the metal of the cooker, by convection currents, i.e. by warming the surrounding air instead of heating the water in the kettle, and by the resistance to the passage of the heat due to the coating of soot on the kettle sides and bottom.

Electricity used to heat a kettle with the elements totally immersed in the liquid may give an efficiency of 99%, and with partly immersed element 95%, or a useful 3,240 thermal units. In these cases, there are no losses beyond those due to conduction through the flexible wire leading to the elements and through the kettle body if placed on a metal surface; and to a small extent to radiation and convection from the polished sides of the clean kettle, for there is no dirt or sooty deposit where electricity is used. With the elements placed underneath the kettle, the efficiency is somewhat lower, and in practice is usually between 85 and 90%, or a useful 2,986 thermal units. When a flat-bottomed kettle is placed over an electric boiling plate, the efficiency is lowered to between 60 and 70%, as additional losses take place through conduction and imperfect metallic contact between the heating surface and the water. For the purpose of comparison I take the usual form of self-contained electric kettle, which is the type most generally used. The three systems compare, therefore, as follows for an expenditure of 1d. or 2 cents.

Fuel Used.	Thermal Units paid for.	Thermal Units Usefully Converted	Efficiency.	Cost of Fuel.
Coal............	45,612	4,561	10%	27/- per ton
Gas............	13,476	4,042	30%	3/- per 1,000 cf.
Electricity.......	3,412	2,986	87½%	1d. per unit

With a very sooty kettle and unfavourable atmospheric and other conditions, the efficiency in practice may fall to 20% or even to 12%, but I have taken average conditions with a kettle in good condition. It is impossible to compare the three systems when instantaneous heating of water is carried out on a small scale. There is no coal-heated geyser on the market for domestic purposes, and the gas geyser has never even claimed to be efficient, for it works under conditions which preclude any approach to reasonable efficiency. Ordinary luminous fishtail burners are chiefly used and these cannot compare with Bunsen or atmospheric burners for efficiency. An electric geyser, on the other hand, has an efficiency closely approximating to 100%, as the heating element is totally immersed; there is no flue, and the working time is too short to allow of any perceptible loss through conduction, radiation or convection.

The 7 lbs. of coal require in practical working 2100 cubic feet of atmospheric air to ensure combustion, which creates a considerable amount of dirt and ashes. The 27.8 cubic ft. of gas require 63.106 cubic feet of atmospheric air to give proper combustion, while considerable fumes and poisonous gases are given off.

Electricity consumes no air and gives off no fumes. In calculating the amount of Electrical Energy necessary to raise the temperature of a given quantity of water to a given degree at about 82% efficiency, a rough but simple rule is to multiply the number of gallons by the number of degrees of temperature through which it is desired to be raised, and to divide by 345.

$$\frac{\text{Gal.} \times \text{T}}{345}$$

Gal. being the number of gallons, T being the degrees.

Suppose as an example, it is required to raise 10 gals. of water from 50° Fahr. to boiling point, 212°.

We have 212−50=162, number of degrees to be raised.

$$\frac{10\times162}{345}=\frac{1620}{345}=4.7 \text{ units,}$$

or nearly 500 watts per gallon or 65 watts per pint. This is on the liberal side, as in a small self-contained kettle 2 pints of water can be raised to boiling point in 12 minutes for a total consumption of 50 watt-hours, which is equivalent (in theory but not quite the same in practice) to 50 watts for 1 hour, or 250 watts for 12 minutes.

For exact calculations at various efficiencies the following table may be useful:

To 212° Fahr. From.	Degrees to be Raised.	Efficiencies. 100%.	90%.	80%.	70%.
		Units required to raise *1 gal. of water* to boiling, 212°.			
	1	0.00244	0.00271	0.00305	0.00349
32°	180	0.444	0.494	0.555	0.635
40°	172	0.419	0.466	0.524	0.600
50°	162	0.395	0.439	0.494	0.565
60°	152	0.371	0.412	0.464	0.531
		Units required to raise *1 pound of water* to boiling, 212°.*			
	1	0.000293	0.000326	0.0003665	0.000419
32°	180	0.05275	0.0586	0.0659	0.0754
40°	172	0.0504	0.056	0.063	0.0721
50°	162	0.0474	0.0527	0.0593	0.0678
60°	152	0.0445	0.0495	0.0556	0.0636

*This table may be applied to any substance by multiplying its specific heat by the figures given.

Electric Water Heaters. It must be understood that there are numbers of patterns of water heaters for which I have no space, differing in appearance and amount of ornamentation, in size and in rapidity of heating, but my readers will be able to form an idea of the large range of these appliances which is available, adapted as they are to every conceivable purpose

where liquids have to be heated. I have given small heaters under kettles, self-contained portable heaters, etc., and have now only to deal with larger and fixed water heaters.

"Belenus" Water Heater. In England, where it is desired to have hot water available all over the house, and to draw large quantities at any desired moment, several patterns have been adopted, in conjunction with the existing circulating system, one being the "Belenus" Electric Boiler, supplied by Messrs. Eastman & Warne, Acton Vale, W., and installed in many private houses, flats and small hotels with great success.

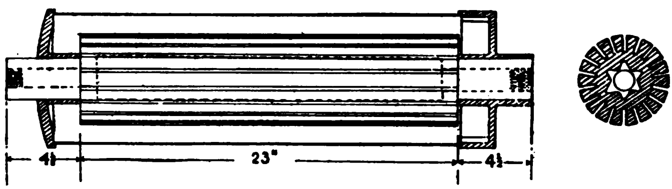
"Belenus" Boiler in Bathroom.

It is a cast-iron cylinder, with corrugations in the interior, to give a large heating surface. There are also deep grooves on the exterior in which the metallic type heating elements are embedded. The water passes through the interior of the cylinder, and cannot come into contact with the heating elements, which are air jacketed.

In the ordinary way the boiler is connected up to a hot-water tank, so that the water automatically circulates through the heater and is stored in the tank, from which it can be drawn as required at taps placed in the bath-room, kitchen and elsewhere.

The heating elements in the boiler are arranged on the "hot point" system, with which this firm's name is so closely connected. These units consist each of a strip of material unaffectde by electrolytic or chemical action, about 1 in. in width, wound with heavy-gauge wire in close turns. The elements are embedded

in the slots shown, these being lined with mica. The "Belenus" boiler can be controlled by 4 or 5 switches to give any output of hot water required. Thus by switching in all the elements, an enormous quantity of hot or boiling water is produced in a few minutes, but this involves a heavy consumption of current, as much perhaps as at the rate of 9 units per hour. It would not be necessary to keep all the elements in use for many minutes at a time, but it is convenient to have the means of getting ample hot water for a bath or for the weekly "wash" at a few minutes' notice. If there is no immediate need for hot water, fewer switches are turned on, the water then heating up more slowly, the current consumption being reduced in exact proportion. If desired this boiler may be used to supplement the kitchen



Section through the "Belenus" Boiler.

boiler, if the coal range be still in use, and in this case it will use but little current to raise the water, already warmed by the coal fire, to boiling point.

"Losles" Electric Water Heater. An electric water heater of a different type from the "Belenus" boiler is the "Losles," invented by Mr. G. Wilkinson, Electrical Engineer to the Harrogate Corporation, and illustrated herewith. The standard heater consists of a cylindrical outer metal casing approximately 15 ins. in diameter and 42 ins. high. The upper part of the case contains the heating chamber, made of sheet copper. This chamber is tinned on the water side, so that the hot water may safely be used for drinking or cooking, in addition to cleaning and bathing purposes. Provision is made for cleaning the water chamber when desirable. The space between the heating chamber and the outer case is filled with a highly efficient heat insulating medium; all connecting pipes enter the chamber at the bottom, these features reducing the radiation losses to a minimum.

The lower portion of the cylindrical case holds the electric connections and the heater pockets. One pocket contains elements connected with a separate supply circuit; under normal conditions this heater does all the work. The second pocket will hold a similar heater to take its current through an ordinary switch, from the heating circuits. This second heater immediately doubles the capacity of the apparatus. But only one heater is in general use, the addition of the second being purely for emergency purposes. The action of the heater is regulated by a thermostat, of extremely simple design, with no moving mechanical parts. Its action is to maintain the temperature of the water at any prescribed and adjustable figure, from boiling-point downwards. Should the temperature drop a few degrees below this point, due to the withdrawal of hot water or the cumulative effect of radiation, the thermostat puts the heater into action, and it remains in circuit until the prearranged temperature is again reached, when the thermostat cuts it out. The chief advantages claimed for the heater are: economical demand for current; high working efficiency; and automatic action.

"Losles" Water Heater.

It will be seen that this heater takes a small amount of current continuously, which is better for many reasons than a heater which takes a heavy current for short periods. The consumer gets the same quantity of hot water at the same cost in both cases, but since with the "Losles" heater only small currents are taken, the wiring and control switches may be smaller and consequently cheaper. The Supply Company prefers a heater of this class for technical reasons.

The apparatus is peculiarly adapted for domestic purposes; it is impossible for the water actually to boil, neither can it become "cooked," as there is no atmospheric contact; con-

sequently, the water can be used for all culinary purposes, and for making of tea, coffee, and the like. Pans used on the hot plates of electric cookers may be filled with water from the heater, so saving expenditure on heating water from atmospheric temperature. The heaviest demand upon the domestic hot-water supply is at night for hot baths, washing up, and so forth. In such case the heater would be charged with comparatively cold water in the late evening. This would be heated during the night hours, ample hot water being available for the early morning. Abnormal demands can be met by the aid of the additional heater already mentioned.

The heater may be placed in any convenient position, preferably, but not necessarily, near the point at which hot water is chiefly required. The heater is quite automatic in action, and fool-proof. Where the heater is used for public buildings, lavatories, schools, or institutions, the thermostat may well be set to maintain a temperature sufficiently high for washing and cleaning purposes only. The "Losles" heater, of course, requires no flue or ventilator, neither is there need for provision for the escape of steam, since this is not generated. The "Losles" heater is of greater durability than gas or other fuel heaters, in which there is a continuous and excessive corrosion of the heating surfaces. The standard heater holds ten gallons of water, and is capable of furnishing about twenty gallons of water per twenty-four hours, raised from 60 degs. Fah. to 210 degs. Fah. This is equivalent to, say, eighty-four gallons per day raised from 60 deg. Fah. to 98 deg. Fah. for bath purposes. For this performance the heater uses one-half unit per hour, costing ½d. or 1 cent.

"Cooper" Electric Water Heater. The Cooper water heater is an interesting example of the heat storage idea, and is the invention of Mr. W. R. Cooper, its manufacture being entrusted to Messrs. Purcell & Nobbs, 87, Cleveland Street, Fitzroy Square, W. Its essential feature is that only a portion of the water contained is heated directly by the immersion element, the remainder being heated indirectly by the portion first mentioned. Thus the water in the cylinder *A* (see diagram under) is heated directly by the immersion heater *B*. The cylinder *A* is surrounded by an outer jacket *C*, a small annular air space being

left between *A* and *C*. The cold water is led into the outer jacket at the bottom, and the inner cylinder draws it from the top of the outer jacket through the pipes marked *F*. The hot water is drawn off from the top of the inner cylinder, where the hottest water collects. Thus the electric energy is used to heat directly, say, one-third of the total water, and consequently the temperature of this portion can be raised fairly rapidly. As the temperature rises, heat is transmitted to an

"Cooper" Water Heater in Bathroom.

increasing extent across the air space, and warms up the water in the surrounding water jacket. Consequently when the water is cold, most of the heat is absorbed in the inner cylinder, and when it is hot the heat is mostly transmitted to the water jacket. By suitably proportioning the electrical input to the total contents of water, boiling of the water can be prevented, even though no water is drawn off. In ordinary working, when the water is drawn off and the temperature falls in the inner cylinder, the heat is absorbed by the inner portion of water instead of being transmitted to the water jacket, and thus the temperature soon rises again. Even when starting from the cold, hot water is soon

available, though the quantity that can be drawn is naturally not so great as when the heater has been left a considerable time.

With an apparatus of this kind the current need not be passed through a meter. The apparatus being continuously in circuit, the consumption per annum would be easily determined, and a fixed charge per quarter could be made. If desired, an additional immersion heater could be fitted, current for which would pass through the meter, and this would be under the control of the consumer, to be switched on if at any time the demand for hot water were much beyond the ordinary requirements. This auxiliary immersion heater could be controlled automatically by a thermosta and regulator swit h. The efficiency of the Cooper heater is stated to exceed 80 per cent., and for an output of 100 gallons daily, raised through 50 deg. F. (say, from 60 deg. F. to 110 deg. F., the temperature of a hot bath), the energy consumption per hour is only three-quarter unit, costing $\frac{3}{4}$d. It will be understood that as in the case of the "Belenus," "Losles," the "Therol" and "Ferranti," this device is intended to be in operation day and night continuously, so that hot water is available at any moment.

"Therol" Water Heater. The "Therol" system of heat storage, invented by Mr. Bell, the Electrical Engineer of Hammersmith, England, and manufactured by the British Thomson-Houston Co., Ltd., was the first practicable attempt to store up energy on consumers' premises at a continuous but low rate, which can subsequently be used for the production of hot water or for cooking purposes, without affecting the power demand. In the "Therol" system a resistance unit running at a comparatively low temperature and rated to take a small, steady supply of current, is housed in the centre of a cast-iron block. In the water heater this block is pierced by tubes connected with a surrounding water jacket, which in turn is fed from the water supply. A thick lagging of asbestos and magnesia completely encloses the water jacket. Heat from the resistance unit raises gradually the temperature of the storage block, until it reaches a maximum of about 500° F., at which point, if no water has been withdrawn in the meantime, loss of heat by conduction through

the lagging, and radiation from the outside surface of the apparatus, balances the energy absorbed. As soon, however, as water is admitted from the jacket to the storage block, it is heated instantaneously and vaporised. A three-way tap permits the temperature of the water to be controlled since it allows cold water direct from the supply; a mixture of cold water with the steam from the storage block, or boiling water alone, to pass out, the temperature of the escaping water remaining constant at any given position of the tap until enough has been drawn to cool down the storage block. A heater taking 200 watts, $\frac{1}{5}$ unit per hour, costing 1d. for five hours, and running continuously night and day, will deliver from 20 to 30 gallons of water daily at a temperature of 110° F., or nine gallons of boiling water, or practically an unlimited supply of warm water. The whole daily output can be withdrawn at one time or as required. To get the highest efficiency, regular supplies of water should be drawn throughout the day, aggregating the output for which the heater is rated, and in this way an efficiency as great as 90 per cent. can be secured. In practice, however, the demand for hot water is neither regular as regards the amount required nor as to the intervals separating the withdrawals. One day there will be but a small supply needed, while another day will make severe calls upon the heater. The "Therol" is able to meet these irregular demands and to respond satisfactorily, but at a slightly lower efficiency. Thus as much as 35 gallons of hot water can be squeezed out after the heater has attained its maximum temperature, but next day a correspondingly smaller quantity is available, the average in ordinary circumstances working out at 25 gallons daily.

"Therol" Water Heater.

Although totally enclosed, the heating unit lasts a great while when continuously in circuit, and its resistance remains constant month after month. Three years is perhaps the average life, although many heaters have been running for longer periods without breakdown. In the event of failure, a new element

"Therol" Water Heater Combined with Laboratory Basin.

can quickly be fitted at small cost without removing the heater.

The "Therol" system has been applied most successfully to lavatory basins where a small and intermittent supply of hot water for washing purposes is needed. An accompanying illus-

tration shows one of the applications, the basin illustrated being self-contained, with water tank and waste. It is designed for use in offices and houses where no lavatory conveniences exist, or where it would be difficult to run water supply and waste pipes. The tank is filled by hand, and holds several gallons. Two taps are provided, one for drawing off cold water and the other for hot water through the storage block, which is fitted below the basin. Rated at 75 watts per hour, or a unit, costing 1d., in 13 hours, the apparatus will deliver from eight to ten gallons of hot water during the twenty-four hours. Where water-pipes exist, a modified pattern of heater is available, and a third design is intended for use where the basin is already fixed.

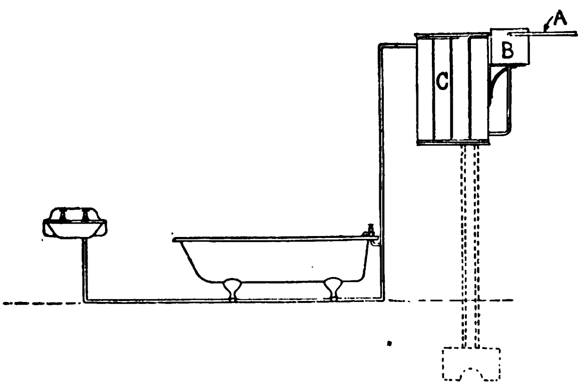


Diagram Showing Water Connections of "Ferranti" Water Heater.

"Ferranti" Water Heater. This apparatus consists of a small cistern *B* (see diagram) fitted with a ball valve and fed by a cold water supply pipe *A*. This cistern discharges into the lower part of a tank heated electrically and contained in the cupboard *C*. The hot water-supply pipe is connected to the tank near the top. The cupboard is fitted with an inspection door which is shown open in the larger illustration of cupboard and supply cistern, disclosing the electrical heating attachment to the tank. The heater consumes 300 to 400 watts, and surrounds a vertical heater pipe which is connected to the lower end of the tank.

and which discharges into the tank slightly above water level. The heater pipe and tank are thoroughly lagged to prevent the loss of heat, and the enclosing cupboard assists very materially in this respect.

"Ferranti" Water Heater.

Starting with everything cold, the water stands at the same level in the tank and in the vertical heater pipe. When the current is switched on, the small volume of water in the heater pipe quickly heats up and expands, and being lighter than the cold water in the tank, its level rises until, at the pre-determined temperature, it overflows on to the top of the cold water in the tank. This permits an equivalent amount of cold water to enter the bottom of the heater pipe and an overflow again takes place as soon as the desired temperature is again attained. Thus hot water at a definite temperature collects in the top of the tank and may be drawn off as desired; a small quantity is available half an hour after the start from "all cold." If no water is drawn for a lengthy period, say during the night, the tank becomes full of heated water at various temperatures increasing from the bottom upwards, and a time arrives when, owing to the expansion of the water in the tank, the discharge of heated water from the heater pipe becomes continuous, and free circulation occurs. If no water is drawn off, the temperature of the water rises until the energy supplied equals the loss of heat from the tank and pipes, or until the water boils and steam escapes through a suitable vent fitted into the tank.

The tank may be connected to the boiler of the kitchen range as indicated by the dotted line, so that an auxiliary supply of hot water may be obtained from a range if in use.

"Ellsee" Water Heater. This has been introduced by the same inventor as the "Ellkay" Patent Bath, which folds into a cabinet and can, therefore be fitted in one's own bedroom. The heater can be fitted in any place where cold water and electric

service is available, and serves for all domestic purposes. The heater consists of a series of tubes surrounding several elements, one or more of which can be switched on at a time. The water circulates through the tubes and the casing surrounding the elements, so that all the heat is absorbed for useful work in the water. The low heat can be left on for many hours to provide a quantity of water heated to 180°, at which temperature it is shut off automatically by a thermostat. The casing is heat insulated; the water, therefore, remains hot for a very long time. The illustrations show the "Ellkay" bath covering the electric heater, fitted in a bedroom. The whole equipment is so simple

Opening Ready for Use.

Bath in Use.

that it can be operated by a child. The bath is counterbalanced and fitted with trapped waste, hot and cold water taps, towel airing rails, etc.

"Bankside" Electric Water Heater. For use in offices or in bathrooms where a limited quantity of hot water is required at more or less regular intervals, an exceedingly effective device, known as the "Bankside" heater, has been evolved. This apparatus, which is in the form of a small urn for office and domestic work, made by the City of London Electric Lighting Co., is of a substantial design, and of very sound mechanical construction; well fitted to bear the brunt of domestic life, where it quite possibly may get more kicks than care. Among its other advantages

it is incapable of steaming dry, and one need never fear that it will be damaged by being left on circuit over long periods. On the base is fixed a cylindrical reservoir with about one gallon water capacity, enclosed in an outer heat-retaining metal jacket. This inner reservoir or boiler is a heavily galvanised iron casting, having a lateral cross pocket near the base. In this pocket is supported a "Quartzalite" immersion heating unit, which is easily replaceable, and works at a moderate temperature, which makes for long life.


"Bankside" Water Heater.

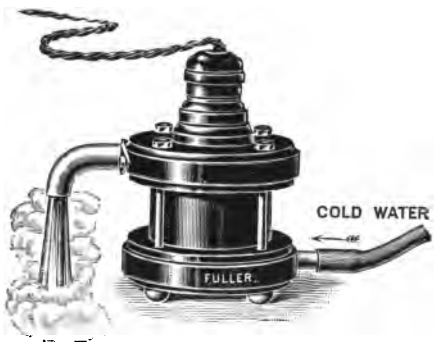
Immediately above this reservoir is a large cup-shaped funnel and condenser, surrounded by an ornamental ventilated casting the latter being topped by a removable cover.

The reservoir, being in direct communication with the funnel cup, cannot be subjected to steam pressure, and is therefore immune from any risk of explosion.

The consumption of energy is at the rate of one-seventh of a unit per hour, the cost being, therefore, 1d. for seven hours' running, the supply to the element being controlled by a rotary switch fixed on the side of the pedestal.

The "Fuller" Geyser. A compact and reliable rapid water heater is the "Fuller" geyser, which is no larger than a pudding-basin. It is cylindrical in form, finished in nickel-plate, and can either be connected permanently to the water pipes or jointed

up temporarily by flexible tubing. It is intended for fixing over a lavatory basin, but may be placed over the sink for furnishing hot water for washing-up, or boiling water for tea or coffee making. No switch is required, and it is only necessary to turn on the water, the latter itself completing the electrical circuit and acting as a resistance to the passage of the current, and thus becoming heated in the process. The moment the tap is turned, hot water, and in a few seconds boiling water, passes out of the geyser. The temperature can be regulated to any extent by adjusting the rate at which the water flows, boiling water being delivered in a thin stream, hot water more quickly and warm



" Fuller " Electric Geyser.

water as fast as it can pass out. Five sizes of geyser are made, to deliver hot water at rates from one pint to one gallon per minute. The current taken by the smallest type is one unit per hour, costing 1d. or 2 cents, the largest model taking 4 units. With such a geyser there is no risk of contaminating the water, which touches nothing inside but porcelain and platinum, and there is no danger of shock or of explosion, and, of course, no fumes, dirt, or smell. For the bed-room the electric geyser is particularly useful when fitted over the wash-stand and supplied either from a tank or connected to the water pipes. It will give hot water for shaving, for washing, or for the morning cup of tea, while in case of illness it is invaluable for giving hot or boiling water at a moment's notice. It is also useful for dentists and doctors for supplying hot water needed in the surgery.


"Jackson" Water Heater.

"Jackson" Rapid Water Heater. Somewhat similar in its purpose to the "Fuller" geyser is the "Jackson" Rapid Water Heater. This useful device was designed originally for fixing to the sides of the Jackson electric cookers, so as to take the place of the side-boiler often met with in coal ranges. It is suitable, however, for independent use, and may be fixed over or near the sink or lavatory basin. It is fitted with a ball-valve and arranged for connection to any main water supply, but may, of course, be filled by hand. The automatic feed is certainly to be preferred. It is made in black iron, with tinned copper interior, and fitted with brass draw-off tap. Two pints of boiling water, or over a gallon of hot water can be drawn off in about four minutes, starting all cold, the current consumption being 2000 watts, or 2 units per hour, costing 2d. or 4 cents. It is intended chiefly for filling sauce-pans or kettles with warm or hot water before they are placed on the boiling discs on the cooker, but may be used direct for tea-making or for supplying water for washing or for washing-up. It has an immersion-type heating element, which gives an exceedingly high efficiency. Although only one heat is arranged for, two-heat regulation can be added at trifling extra cost, and in my opinion this is desirable so that a large quantity of water can be kept at boiling point for any length of time with little consumption of energy. The vessel holds about 2 gallons. The "Jackson" Instantaneous Water Heater shown in the second


"Jackson" Instantaneous Water Heater.

illustration has been designed especially for dentists' use, but is also suitable for the table, taking the place of the old-fashioned urn or hot-water jug. Filled with cold water, it will deliver half-a-pint of hot water in 10 seconds, or boiling water in less than half a minute. It holds about 7 pints, and consumes 1000 watts, costing therefore 1d. per hour to run. It is most ornate in appearance, with bronze base and oxydised silver spherical container.

"Simplex" Water Heater.

Simplex Rapid Water Heater. A useful rapid water heater for kitchen or counter use has been designed by the English Simplex Co. This is shown in the accompanying illustration. It is shaped like a gas-heated urn, and is of solid copper, with a capacity of four pints. Two flush switches are mounted in the box, and the elements are fixed at the bottom of the water vessel. Current is taken at the rate of 900 watts at full heat, two lower heats being provided for, with a consumption of 250 and 600 watts respectively. A supply of hot water is available directly the current is switched on, and boiling water within a few moments. This device is not intended for permanent connection to the water system, but is self-contained, and is filled at the top by lifting off the lid. It is recommended as a safe, reliable and speedy heater.

ELECTRIC HEATING

We now come to the important question of heating our rooms in order to keep ourselves at a comfortable and healthy temperature.

Heating by electricity can be carried out by three different systems:

By radiation, in the same way as the sun warms the earth; *By convection,* by which is understood the direct heating of air by contact with a heated surface; and *By conduction,* which is the effect produced upon solid objects which are in contact with others at a higher temperature, the heat travelling along the metal or other material and warming it. The last system is only made use of to a very small effect, but a certain amount of conducted heat is given off from any solid body which touches another solid body at a lower temperature, and every heating appliance gives out a greater or less proportion of its energy in the form of conducted heat. I have already referred to the electric radiators and to the principles governing their method of heating, and also to convectors,


"Siemens" Radiator.

and I now propose to illustrate and to describe some representative examples of electric heaters as used in practice for domestic application, and I shall also deal with combination heaters which give out both radiant and convected heat. To sum up the matter in a few words, it may be said that luminous radiators are desirable where an immediate heating effect and a cheerful appearance are required; that convectors are suitable for all-day use, and for warming the air of rooms and passages in which immediate heat is of no advantage and a cheerful appearance is of little consequence, while radio-convectors are appreciated where immediate heat is desired, combined with a capacity for raising quickly the temperature of the room—a glowing fire-like effect making an effective successor to the coal or gas fire.

The extreme convenience of an electric fire in the home is perhaps more appreciated during our chilly spring and summer evenings than at any other time of the year. A cosy, cheerful warmth, whilst having breakfast or dinner, makes the whole difference. This is instantly available with the help of electricity without the trouble of laying, lighting or cleaning up afterwards, as with a coal fire.

Efficiency. It is important to remember that all electric heaters, of whatever make or system, have an efficiency of 100%, that is to say, the whole of the energy put into them is given out again in useful heat. There is no flue to carry away any portion of the


A "Dowsing" Radiator.

heat, and there is no waste whatever, every particle of heat produced is available for warming the room and the persons in it.

The efficiency of an open coal fire is extremely low, compared with its theoretical heating capacity. Upwards of 90% of the heat stored up in the coal is wasted up the flue, and less than 10% is thrown out into the room and can be used for the purpose for which the fire exists. The gas fire is also highly inefficient. Careful tests prove that the efficiency of the best gas fire is certainly not more than 20% under most favourable conditions. In other words, a user pays for five times more heat than he can get if he employs a gas fire, and for 10 times as much heat as he is able to secure when he depends upon an open coal fire. If it were possible to design a gas or coal fire which needed no outlet or chimney, the efficiency might be increased very materially, but as combustion is taking place, the products of combustion must be got rid of, and in doing this a much greater proportion of the heat is lost than theoretically is necessary. In the case of an electric heater, a user pays for only that heat which is available in the room and for no more. He pays nothing when the heater is switched off, he pays nothing except for the actual period during which it is being used. A gas fire gives out no useful heat for many minutes after being lighted; a coal fire must burn up and get rid of what is commonly called *smoke* before any heat is available in the room. The gas fire goes on heating for some time after it is turned out, the coal fire must be allowed to burn out. The gas used in heating up the stove itself and the fuel surrounding the burners, must be paid for, and is practically all wasted, since the heat given out after turning off the gas when leaving the room is of no value. The coal in an open grate must also first heat the stove before much useful heat is available, and, when the fire is no longer required, the coal goes on burning, and must be paid for; with the electric heater, however, there is no waiting, no waste, no dirt, no smell, no smoke, no danger, and no uncertainty. It needs no attention; is portable and can be placed anywhere about the room; can always be depended upon; always gives out a steady and uniform heat, and is ready for service at a moment's notice without troubling a servant. There are no ashes to clear away, no wood to chop,

no fire laying to do, no carrying of coal; no searching for matches, no doubt as to whether the fire will burn up, no risk of explosion or back-firing as with a gas fire, no down draught to fill the room with smoke or the deadly fumes from gas burners—in brief there is no nonsense with electricity. It is all plain sailing, just turn the switch and electricity does the rest, and does it every time alike. The electric fire is ideal; it is the acme of comfort, convenience, cleanliness, ready service, adaptability and efficiency. It is moreover not expensive if current be available at low rates, but even if it were twice as costly as gas, the extra expense would be more than compensated for by the advantages mentioned above.

Amount of Heat Required for Warming a Room. It is unwise to fix any *definite* rule for ascertaining the heat required by any system to warm a room of given cubic area. A great deal depends upon not only the dimensions, but the number, position and shape of the windows and doors, the number of outside walls and their thickness, the outside temperature, the wind, the frequency with which doors and windows are opened, and similar details. One room with a large draughty window opposite the door, with two walls exposed and facing north or north-east, may take a heater of double the power needed for an apartment of similar dimensions, with a smaller window, protected from draught and with a small expanse of outside wall. As a general rule, however, for ascertaining the electrical energy required, it may be taken that 1 watt per cubic foot is needed to maintain a comfortable temperature, except in the depth of winter. Thus for a room measuring 10′ high by 10′ wide and 10′ long, a heater taking 1000 watts, or 1 unit per hour, must be provided as a minimum.


Luminous Radiator of the General Electric Co. of America.

It is, however, advisable to provide double this amount and instal heaters capable of absorbing 2 watts per cubic ft. of air-space for RAISING *the air in the room quickly to a comfortable temperature, reduceable to 1 watt per cu. ft. to maintain that*

temperature, assuming the room is not unduly exposed, the window surface about $\frac{1}{8}$ the total wall surface and the air changed not more than 3 times an hour. 1 watt per cu. ft. should maintain the temperature of the room 25° Fah. above the mean initial temperature.

A further general rule may be taken as follows, viz.: Allow 0.2 watts per cu. ft. of air-space for every 5° Fah. increase of temperature required to be maintained.

This applies equally, whether the heater be a luminous radiator, a convector or a radio-convector.

Nowadays with electricity at $\frac{1}{2}$d. in England and 2 cents in America per unit, or even 1d. in England and 4 cents in America, greater freedom in the use of electric heaters is permissible, and it is becoming the practice to instal apparatus much more powerful for a given cubic area than was the case some years ago. It is not so much that the less powerful heater will not raise the temperature to a comfortable degree or maintain it at that heat, but that with a larger heater the required temperature can be reached much more rapidly than would otherwise be possible. As soon as the air of the room reaches say 60° F., half or more of the elements of the heater can be switched off, the elements remaining in circuit being sufficient to maintain that temperature. In this way no greater consumption of current necessarily is involved, because a more powerful heater can be switched to to half or quarter heat after a shorter time than would be practicable with a smaller radiator. It is wise to put in a heater which is capable of warming the room adequately in any weather without undue delay, for it is not necessary in mild weather to turn it to full heat at all, the lower heats being all that is required to give a comfortable working temperature. In the short spells of sharp frost experienced in England, a powerful heater is very welcome, and will give satisfaction where a small radiator would be condemned as ineffectual.


"Eclipse" Heater.

Luminous Radiators. I have already referred to the work of Mr. H. J. Dowsing,

M.I.E.E., as one of the pioneers of Electric Cooking and Heating, and to him we owe the "radiant lamp" system of electric heating, which he first introduced in 1899. An early improvement was the use by Mr. Dowsing of special reflectors behind the lamps to reflect the radiant heat from the glowing filaments into the room and in this way the filaments were protected from becoming overheated and the life lengthened. These reflectors also assist the convection process by providing channels for the air heated by contact with globes and metal reflectors. These special reflectors were patented, and are shown in the radiator shown on page 221, made by the Dowsing Radiant Heat Co.

The luminous type of heater consists of one, two or a larger number of tubular lamps arranged in an ornamental case designed to harmonize with the decorations of the room in which it is to be used. It appeals strongly to women on account of its bright appearance and the rapidity with which it gives out its cheerful warm glow, which has been aptly termed "bottled sunshine." Luminous heaters are very handy to take from room to room, and when so placed as to be free from risk of accidental knocks or of overturning, they last for many years. With ordinary use the lamps, with care, will last 3 or 4 years, and if run all day long, need renewal about once in 6 months. I am able to give a few examples of the latest forms in which they are now supplied; some, as will be seen, are of very pleasing design.

The simplest form of luminous radiator has only one lamp, with or without a reflector. It is a useful type of heater for small rooms, such as bathrooms, nurseries, where an even comfortable temperature is required. It may be used also to supplement the main heating system by providing for local warmth at a writing desk or table, as shown on page 10. It forms a portable fire, and its small consumption allows of its being connected to any lampholder without undue expense in cases where a separate heating circuit is not available. It costs ¼d. an hour to run with energy at 1d. per unit. In motor garages it is useful for placing under the car to prevent the cooling water freezing in the cylinder jackets and cracking them.

Two-lamp Radiator.

"Simplex" Radiator.

For somewhat larger rooms radiators having two lamps will be found useful. Such a heater is here shown, the case being of ornamental polished brass, with copper reflector. It takes twice as much current as a heater with a single lamp, the cost of running being ½d. per hour, but it is proportionately more powerful as a heater, and will be found quite sufficient for a small study, for a large bathroom or small bedroom. Most makers of radiators supply them for one, two, four or more lamps. Luminous radiators cost anything from a few shillings upwards, the price depending upon the amount of material used in the cases and the quality of workmanship involved in their manufacture. A cheap radiator will give out as much warmth as the most expensive, but it will not last so long, owing to its more flimsy construction, and it is not so elegant in appearance. A very good 4-lamp radiator can be bought for £2, or $10, better qualities costing anything up to £15 or $75.

The three-lamp radiator here reproduced is a particularly substantial pattern, intended to withstand rough usage. Many luminous radiators have the disadvantage that they are so light in construction that they may easily be overturned, with risk of breaking the lamps. The type under discussion is as steady as a table, and will last for many years. It consists of a handsomely finished ornamental oxydised copper metal frame with a polished corrugated copper reflector. It is fitted with either two, three or four frosted radiator lamps, which give a pleasant diffused glow. The terminals of

"Westinghouse" Three-lamp Radiator.

A Handsome Radiator.

the radiator are covered by a solid shield which protects and thoroughly insulates them. It may be noticed that the metal caps of the lamps and the holders for them do not show in this style of radiator. This is due to the fact that the ordinary bayonet type of holder and cap is replaced by a screw cap and holder, in accordance with practice which has become standardised in America but has been hitherto seldom met with in England. The lamps, therefore, screw into sockets recessed in the base of the radiator, so that they are held firmly in a vertical position. A fault commonly met with in luminous radiators is that the lamps are inclined to shake about, their support in the ordinary holders being sometimes unsatisfactory. Radiators with screw-cap lamps are now supplied by most if not all the best makers.

Mr. Dowsing has introduced a pin contact form of holder which holds the radiator lamp very firmly and straight. It is supplied by the Dowsing Radiant Heat Co., London, but needs special caps for the heating lamps.

My next illustration is a 4-lamp radiator made by the British Prometheus Co. This is a standard design, and typical of this firm's high-class workmanship. It takes 1000 watts per hour, costing therefore 1d. per hour to run with all four lamps in use. It is not necessary to have all the lamps alight together, for in the base of the heater are 2 switches, which permit of two or four lamps being used. Half heat is sufficient in most circumstances to maintain a comfortable temperature in a small room after it has been raised to that point by the 4 lamps.

" Siemens " 4-Lamp Radiator.

A " Prometheus " Radiator.

Another style of radiator is that shown on previous page 223, which is listed by the British Thomson-Houston Co., Ltd., Rugby, and the General Electric Co., of Schenectady, New York. This is a handsome design in the Adam style, intended to harmonise with period decorations. It has 2 heat controls, and is of substantial construction, each lamp having a separate compartment.

It should not be forgotten that as luminous radiators give out the greater proportion of their energy in the form of radiant heat, which passes through, without heating, the air, the warmth from these devices can be felt on the body just as much in the open air as indoors, and a current of air passing between the heater and the person warming himself does not affect the radiant heat reaching him, although it carries off the convected heat rising from the warm surfaces of the radiator. It will warm a person almost as well if a sheet of glass be interposed between

Mantel Type Radiator.

Radiator with Horizontal Lamps.

him and the radiator, since glass does not hinder the passage of luminous heat, any more than it does the transmission of light.

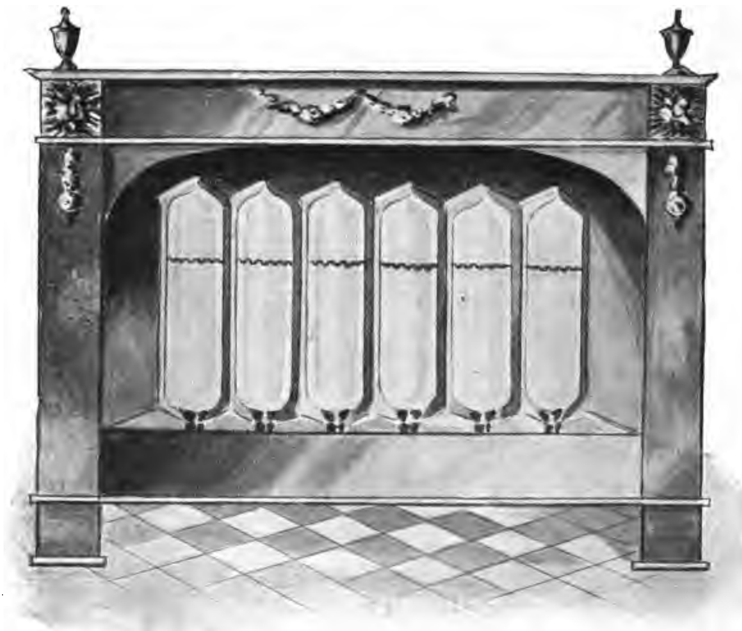
A novel form of radiator is shown with 4 lamps, arranged horizontally instead of vertically. The heating effect is identical in both cases, but the horizontal arrangement has several advantages, the most noteworthy being that the lamps are supported at both ends. This not only ensures rigidity, but obviates risk of short-circuit, since the two wires conducting the current are separated by the whole width of radiator. This heater is made by Simplex Conduits, Ltd., whose large range of luminous radiators, varies from a simple three-lamp type to an elaborate six-lamp design similar to the pattern illustrated. Intermediate with these two types are some thirty other patterns from which the buyer may select. The six-lamp radiator illustrated is a powerful heater, sufficient to warm a

Six-lamp "Simplex" Radiator.

"Siemens" Four-lamp Radiator.

room 15′×12′×9′ high. With all lamps running, the cost works out at 1½d. per hour, but after the room has become warm, two or four lamps are quite sufficient to maintain the temperature, the three switches shown on the box enabling 2, 4 or 6 lamps to be used as desired.

I have already referred to the Dowsing radiators supplied by the Dowsing Radiant Heat Co., and I am now able to repro-

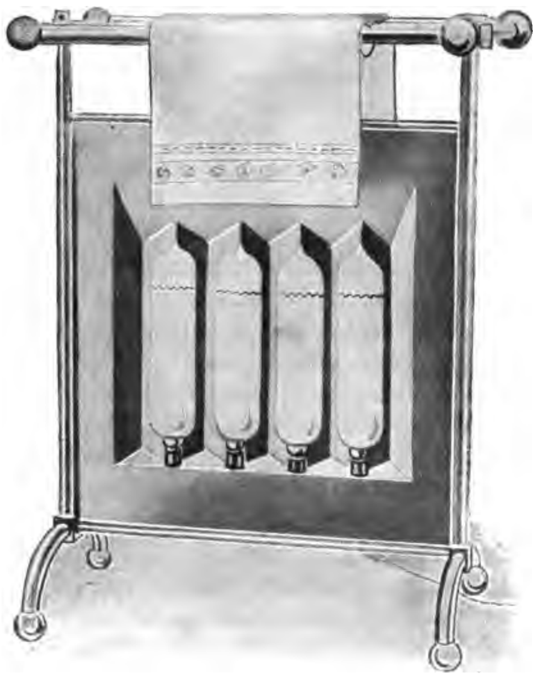


A Powerful "Dowsing" Radiator.

duce a representative pattern of a large 6-lamp radiator intended for heating rooms up to a capacity of 1500 cubic ft. (13′×14′×9′ high). As each lamp takes 250 watts, the total consumption of the radiator is 1500 watts, the cost of running at full heat being, therefore, 1½d per hour, assuming in this case, as I have done all through this book, that current is supplied at 1d. per unit.

When a large room has to be heated electrically, it is better in my opinion to use two small radiators rather than one large

heater. The radiators can be placed in any position, one at each end of the room, for example, or they may be moved about if a concentrated heat is required. They are independent of the fireplace, and should never be placed in front of a coal grate unless the register is closed up entirely, otherwise a large proportion of the convected heat given off is lost up the chimney. This precaution is more important in the case of a convector



"Dowsing" Radiator or Towel Airer.

than of a radiator, as the former heats almost entirely by convection currents.

Luminous heaters are most convenient for airing towels and clothing, and any lady who has tried them for the purpose will confirm my statement that airing can be done in this way more thoroughly and satisfactorily than by a fire. There is no risk of scorching or of the clothes getting out of shape through excessive heat, and a pile of damp clothes can be aired right

"Simplex" Convector.

through without the necessity of changing their position. It will be seen from the illustration that in one Dowsing radiator, provision is made for airing, in the shape of a rail over which towels or clothes may be hung without danger of actually touching the lamps, which might scorch them. A chair placed in front of any lamp radiator is a fairly satisfactory makeshift, or with care the clothes may be placed on the radiator itself if it has a flat perforated top.

Convectors. The convector or air-warmer is the oldest form of electric heater, and was first introduced about 1894 by Crompton, and afterwards by the General Electric Co. Convectors are now made by nearly every firm engaged in the manufacture of electrical accessories, and they are supplied at any price from a few shillings upwards, according to their heating capacity, design and workmanship. As with luminous radiators, a cheap heater will give out warmth equal to that of the most costly pattern, but it will only be plain in style, suitable for positions where appearance is not of much consequence. A convector is never so cheerful in appearance as a luminous radiator, as no source of heat is visible, but in many patterns a coloured lamp is placed inside to obviate the disadvantage. Present-day convectors show a great advance upon those available even a few years ago, improvements having been effected chiefly in the character of the heating element. A convector element is not designed to work at anything like the temperature at which the element in a grill or under a hot plate operates, and its life is, therefore, proportionately longer. I have convectors which have been in use every day for 2 years, and have needed no renewal of the elements, and with ordinary usage the elements should last up to 3 years. With most convectors, control of the heat is effected by switches mounted on the front or side, the usual arrangement being "full," "half" and "quarter" heats, secured by two switches. The element is usually a nichrome or similar wire, wound over strips of mica supported on the frame inside, its temperature being much

Westinghouse Convector.

"Siemens" Convector.

below red heat. Another style of element consists of spirals of similar wire wound over fire-clay rods, while in a third form the heating effect is produced by passing the current through exceedingly thin deposits of copper and gold on a mica base. A convector, as already explained, causes a current of heated air to rise into the room, the device being open at the bottom and perforated at the top to assist in the circulation process. Con-

"Carron" Convector.

"Prometheus" Convector.

A Handsome Box-form Convector.

vectors lend themselves to very artistic treatment in the design and ornamentation of the case, and there are hundreds of beautiful patterns to be seen in the showrooms of electric supply undertakings and dealers. I am only able to illustrate a few typical designs of recent production, but my readers can form a good idea from these as to the great variety which can be obtained.

The pattern here illustrated is a cheap form suitable for use in small rooms, where a plain design serves the purpose. It has a matt black iron body, with repousse ornamentation relieved bright. It has no switches, but heat control is effected at the wall-plug from which the supply of current is taken. It takes 1000 watts and costs, therefore, 1d. or 2 cents an hour to run. A similarly cheap and efficient convector is the Westinghouse. An exceedingly handsome convector is the example shown on the previous page, which is constructed in gilt brass in the style of Louis XV. It is intended to match rooms furnished in French style, and forms an ornament as well as a heater. It takes $2\frac{1}{2}$ units per hour, and when full on costs $2\frac{1}{2}$d. or 5 cents to run. Three degrees of heat can be obtained, the consumption being at the lower heats $\frac{1}{2}$ and $\frac{1}{4}$ of the maximum respectively. The perforated panels in front allow of a red

"Siemens" Iron Convector.

Dowsing "Hot-bar" Radiator.

glow being seen from one or more ruby lamps placed inside. These do not add appreciably to the heating effect, but give a cheerful warm glow which somewhat resembles that from a fire, and improves materially the appearance of the heater when in operation. Another ornate design completes the selection for which I have space. This is in polished brass, with heavy cast feet and perforated panels, behind which are placed ruby lamps. Such a heater is suitable for drawing-room use, and is exceedingly elegant in appearance. It costs 1½d. or 3 cents per hour to run at full heat, the switch control providing for three degrees.

Convectors are made in tubular form or special shapes for heating greenhouses, bathrooms, passages and so forth, and for fixing beneath windows so as to warm the air as it enters the room. This, indeed is the most suitable place for such a heater, draughts of cold air from outside being thus eliminated.

Radio-Convectors. Radio-convectors combine the advantages of the luminous radiator with those of the convector, and give out a cheerful warm glow from incandescent heating elements, while warming the air directly by convection currents. They are comparatively a new departure in electric heating, rendered possible by the introduction of resistance wires which can safely be run continuously at red heat without deterioration.

"Ferranti" Box-type Electric Fire.

Radio-convectors, or electric fires as they are often called, are the closest approach yet made to the glow of a coal fire, the heating surface being at

"Cozy Corner" Heater.

a bright red. Their cheerful appearance, powerful heating effect and artistic forms have caused them rapidly to grow in popularity, and the real red-heat electric fire is now recognised as the most suitable and pleasant method of obtaining heat for domestic purposes. A further advantage of the red-hot system is that toast can be made by holding bread in front, as with a coal fire, and that articles of clothing can be aired quickly by its means, while it is possible to ignite paper or to light a cigarette at the glowing surface. Unlike the coal fire, the electric red-hot stove is always alike, not dull black one minute and brighter the next, but it glows with a steady brightness which has a most cheerful and homely effect.

For those who prefer the lamp style of heater, and yet desire to have immediate air warming as well, there are combined luminous heaters and convectors, in which heating lamps are employed in conjunction with non-luminous wire elements. Either or both sections may be used as desired, the convector portion being controlled separately from the lamps.

"Blaze" Radio-convector.

The two heaters here illustrated are supplied by Messrs. Siemens, and have spirals of special wire enclosed in tubes of silica, which glow with a bright red heat when in operation. The wire used is treated by a chemical process only recently introduced, which permits of running for long periods at a temperature approaching incandescence without risk of oxidisation or atmospheric action, the wire being unaffected by frequent switching on and off,

Two Patterns of "Dowsing" Hot-bar Radiator.

and by rapid temperature changes. By the use of polished copper reflectors, a blaze of soft red light is given over the whole of the front surface of the radiator, the effect being delightful. When eventually the element does give up, a new one can be put in very quickly by any householder who can use a screwdriver. The "Cozy Corner" heater costs $\frac{3}{4}$d. (1.5 cents) an hour to run, and the "Blaze" heater 1d. to $1\frac{1}{2}$d. (2 to 3 cents), according to size. Both designs may be had in matt black iron, in polished brass or in polished copper.

The Dowsing Radiant Heat Co., of London, has lately introduced a system of radio-convectors, termed "hot-bar" radiators, and I show here a couple of its most recent designs. In these heaters a spiral of nichrome or similar resistance wire is laid in zigzag grooves formed in blocks of fire-clay, run up to incandescence. In front, acting as a cover, is a strip of flat quartz, which becomes red hot, but unlike glass, does not crack if water or grease be thrown on it. These heaters are very powerful, but consume more current than most of those already referred to, the usual rating being 2 units per hour at full heat, costing 2d. (or 4 cents). Another and deservedly popular style of glowing red radiator is the Ferranti fire here illustrated, in a few different patterns, but all working on the same

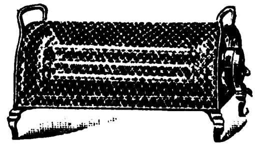
"Ferranti" Fire

principle. It consists of a circular disc of quartz glass behind which is a flat spiral of thin metal ribbon or wire, the turns being separated by mica. The quartz plate glows all over with a bright red heat when the heater is switched on, and the heat, which is partly radiant and partly convected, is reflected by the bowl-shaped frame of polished copper surrounding the element. This reflector can be swivelled to any angle, and the heat focussed consequently in any direction. It is a charming system, and quite a departure from conventional ideas. Ferranti heaters are made to harmonize with period or modern styles of decoration, and in several finishes. The heating element is detachable and can readily be renewed when necessary. On very similar lines is the "Redglo" fire, which consists of a convex reflector and stand into which is bolted a separate fire unit, attached by means of four bolts. The unit is, of course, the essential part, and this has been designed in such a way that a maximum of radiant heat is given out in a forward direction, eliminating losses at the back of the fire.

Duplex "Ferranti" Fire.

Within a few moments of the current being switched on, the fire attains the appearance and temperature of a red-hot hemispherical globe, at which paper can easily be lighted. It is claimed that this fire gives a large red-hot surface for a given current consumption. The quartz bowl which covers the heating coil has an area of 23 sq. inches, and the current consumption is 600 watts. The cost of running is, therefore, .6d. per hour, or 1.2 cents.

"Ferranti" Fire with Adjustable Bowl Reflector.



BASTIAN OR QUARTZALITE HEATERS.

The first heater in which quartz was employed, in fact the original system, was the Bastian or Quartzalite. In these devices a small spiral of nichrome wire is threaded through tubes of quartz glass supported in a frame. These glow with a bright red, and are exceedingly effective as heaters, a polished reflector throwing the heat forward. A couple of representative Quartzalite designs are shown herewith. The elements may easily be renewed, and are quite cheap.

Bastian heaters may be constructed with any desired number of glowers, the most usual being 12, the current consumption in this case being at the rate of 1500 watts, costing 1½d. or 3 cents per hour at full heat. Half the number may be switched off if less heat is needed, or both sets of elements may be connected in series to give only one-quarter of the heating effect. These changes are effected by switches mounted on the frame of the heater.

"Medina" Heater.

The Bastian quartz heaters are used on a large number of British battleships. The one here illustrated shows one of several fitted in Buckingham Palace, Marlborough House and in Queen Alexandra's bedroom. The Royal quarters on the "Medina" yacht were fitted with Bastian Heaters, as are also the banqueting hall of the Masonic

Temple at the Holborn Restaurant, and the banqueting hall at Frascati's Restaurant. These heaters are supplied by the Bastian Heating Synd., the Edison & Swan Co., Messrs. Drake & Gorham, and by most electric supply undertakings, and agents in Great Britain and America.

"Belling" Fire in a Dining Room.

A very successful electric fire is that by Belling & Co., Edmonton, London, the elements employed being a non-oxidising wire wound on one side of a slotted fireproof bar, the slots being so arranged that the wire is held $\frac{1}{8}''$ clear of, and parallel to, the face of the bar. Thus it works in free air, and cannot become overheated.

The bars are strengthened by an embedded wire to guard against accidental breakage, this wire holding the bar together even if it be cracked in several places. Several of these elements are mounted in a frame, with a polished reflector at the back. The elements are renewable, and replacements can be made without disturbing or removing the apparatus. By means of the adjustable bracket shown, the tea-pot or coffee jug may be kept hot or a portion of food kept warm for a late arrival.

A novel and particularly effective form of electric fire is made by Messrs. Neville Williams & Co., of London, and is illustrated herewith. The case is of wrought iron, with a copper ledge in front. This design is suitable for office, bedroom, or library

An "Ensign" Electric Fire.

use, and is listed at a price which brings it within the reach of any householder who has electric light. For drawing-room use, or for places where a more ornamental appearance is desired, alternative patterns are offered. In all the styles, however, a standard "fire-box" is provided, which is interchangeable and easily removed when necessary. This fire-box is of sheet iron, and contains a glazed fire-clay block with grooved and rounded front, in which the heating elements are placed. The latter consists of a spiral tape of nichrome or similar resistance alloy. There are eight spirals in all, two switches being provided, so that half or all may be used, as desired. The spirals are protected in front by a metallic gauze of similar material to that used for the heating unit. The elements run at a bright red heat, and are

guaranteed for twelve months. New fire-boxes are supplied for a few shillings—about half the cost of lamps for a luminous radiator. A large proportion of the energy used is given out as radiant heat, the glazed surface of the fire-clay forming an effective reflector. It takes several minutes for the elements to reach their full temperature, but convected heat is given out from the moment the switch is turned. Although not intended for use as a cooker, the "Ensign" fire makes excellent toast, while by the

Another Ensign of "Ensign" Fire.

use of a specially-shaped kettle, resting on the shelf in front, a quart of cold water can be brought to boiling point in from twenty to thirty minutes. The appearance of the "Ensign" fire is very cheerful, the glowing elements and the heated fire-clay base forming an effective substitute for a coal fire. At full heat the fire takes about 1350 watts, the running cost being therefore 1.3d. per hour, or less than 3 cents.

Bed Warming by Electricity. In a household with several spare bedrooms it is difficult to keep the bed linen aired for immediate use, but with an electrically-heated pad, which can

be placed between the sheets of a bed when not in use, it can be kept aired with no trouble. It is not necessary to keep it on all the time, but only for short periods at intervals, so as to drive off any damp which may be present. Such pads have other uses, and are invaluable for local application to reduce pain and inflammation. As a successor to the hot-water bottle, the electric pad is ideal. It is more comfortable and pliable, and adjusts itself to any part of the body.

Best of all it will not " cool off " just when relief seems near, but maintains an even, soothing heat as long as desired.

The pad, soft and flexible, covered with eiderdown, can be used in any position and is so light that it is never uncomfortable. Always ready, night and day, it only requires attaching by the plug on the cord to an electric lamp socket.

Bed-warmer.

For pain and inflammation where a hot application is needed the pad more fully meets every requirement. For muscular trouble it is particularly desirable because it can be applied in any position.

In the nursery or the invalid's room it affords comfort in many ways, such as in warming the bed before retiring.

Moist applications, such as poultices, can be kept warm by using with the pad the rubber cover made for the purpose. As a foot warmer it is much liked by invalids and elderly people.

Each pad is supplied with a length of flexible cord, long enough to reach from the lamp socket to a bed or chair.

The maximum temperature is limited automatically to about 180° F. Those supplied with a regulating switch give three degrees of heat. The switch is on the cord within easy reach, that the heat may be controlled without rising. It is in the form of a separable connector so constructed that what heat is " ON " may be known by the sense of touch, without the bother of looking at it. When " OFF " the separation of the

connector makes certain to the sleepy one that it actually is disconnected.

Heating pads are made by the Simplex Heating Company of America, the Schniewindt Electric Co., Birmingham, Landeau & Co., London, and others, who also make electrically heated carpets and mats. The carpets and mats are very useful for warming

Heating Pad. (Simplex Co. of America).

the feet under the table or desk, and are made in many different sizes and patterns to suit their surroundings. Both carpets and pads consume current at the rate of 250 watts per sq. yard, that is, one-quarter of a unit per hour, a pad measuring one sq. yard costing, therefore, $\frac{1}{4}$d. or .5 cent per hour to run. The resistance element is woven in asbestos or similar fabric in the thickness of the carpet or between fancy covers of cloth or other material.

The pads, which usually measure 12 ins, by 16 ins., are useful not only for bed warming, but are convenient for table use for keeping plates and food warm. Running with the cover exposed to the air, the temperature never rises beyond a confortable heat, but when used as a bed-warmer or attached to the body for medical purposes, and covered closely by bedclothes or clothing, the heat is confined, and would rise unduly but for the provision of an automatic thermal cut-out, which breaks the circuit when the maximum temperature has been reached and switches it on again when the element has cooled down. For carpet or table use, one heat only is needed, but for medical purposes heat regulation is rquired, and a three-heat plug is fitted to the flexible connecting cable which allows of three changes of temperature.

In addition to heating pads there are electric warming bottles, such as the "Radcliff," also plaques and discs which take a very small quantity of electricity and do not need thermostat control.

Electric Foot Warmers. It is surprising how, when seated at the table or desk, even in a warm room, the feet become cold, and if one desired to keep at work, one must either put up with cold feet or use a water bottle or similar contrivance. The introduction of electrically-heated foot warmers, however, gets over the trouble most conveniently. They are made in various forms and sizes, a representative sample being shown in the accompanying illustration. This has a mahogany frame on short feet, with a cane top, the heating element being placed underneath. With such a heater, it is impossible for the feet to remain cold, yet the cost of running is but a fraction of a penny per hour. Such heaters are also convenient for keeping dishes or plates warm, and for airing small articles of clothing, while if placed in the linen closet, they will keep the sheets and house linen beautifully warm and aired.

"Electroyl" Foot-warmer.

VENTILATION AND AIR PURIFICATION

The easiest way to ventilate a room or building is by the use of a suitable electric fan. A portable fan does little towards ventilation; it creates a current of air and is very welcome in the summer, but it does not *change* the air. In the kitchen particularly it is necessary to secure adequate ventilation and cooling, and this can best be accomplished by fixing an " exhaust " type of electric fan over the window or in an outside wall. This will expel the foul and heated air and draw in fresh supplies of clean fresh air from the windows and doors. It can easily be fitted and costs but little to install, while it may be run all day for a penny or so. It creates no draught, and can be controlled by a switch on the wall or by a cord hanging down from the machine.

For cooling the house in summer and insuring an adequate supply of warm fresh air in winter, the incoming air should be cooled or heated where it enters the building. This is not generally possible with houses built in the ordinary way, but if architects who design residences were to provide for electric heating, cooking and ventilation, there would be no need for chimneys nor for open doors and windows. In winter, electric heaters would be placed where a fan draws in the cold air from outside, the air filtered and warmed before passing into the room, and the vitiated air expelled at the top of the room by means of an exhaust fan discharging into the atmosphere outside or into ventilating ducts throughout the building taking the place of chimneys. This is perhaps a counsel of perfection, but it is the ideal and sensible way of warming the house properly and without draught. It permits of an even temperature throughout the building, the rooms, passages and hall being alike maintained at an equable heat. In summer, the air instead of being warmed when it enters, is cooled by an electrically operated refrigerator,

and is distributed without draught through the various rooms, maintaining a temperature several degrees below that prevailing outside, the heated air being expelled by the exhaust fan already mentioned. There is no need to have a separate inlet and exhaust fan for every room, provided a system of fresh air and exhaust ducts is installed, one of each being sufficient for the largest building, its capacity varying, of course, with the size of building in which it is installed.

As bracket fan. As table or desk fan.

Universal Electric Fan. (Sun Electrical Co., Ld., London.)

In the absence of a complete electric ventilating system, such as I have outlined and such as will eventually be provided by the architects of all but the smallest class of property, we can improve existing conditions by employing fixed and portable electric fans.

Portable fans may be of several types, suitable for use on the table or desk, for attachment to the wall or for fixing to the ceiling. Although, as I have mentioned previously, they do not really ventilate the room, unless scientifically arranged, they are delightful in hot and sultry weather. They create a welcome and cooling breeze which makes work possible on the closest of days, and forms a substitute for those natural air movements which temper otherwise unbearable heat.

An electric fan weighs only a few pounds and can be connected

to any lamp-holder or to the nearest wall socket by a length of flexible cord. Its speed can be regulated at will by a lever at the base of the fan, and the direction of the breeze may be varied either by moving the fan as a whole or by altering the angle at which the blades rotate in relation to the stand. Many types of fan can be swivelled through a wide angle, and in other patterns an oscillating base is provided which alters automatically the direction of the air current, so that every part of the room in turn feels the cooling effect. Some fans can, by the use of an adjusting knuckle, be used either as a desk or table fan or as a bracket fan, and I illustrate one such herewith. A ceiling pattern can be arranged in conjunction with the centre electrolier, or it may be quite separate, and it is controlled independently, of course, of the light. In most cases it is a fixture in this form, and one of the switches at the door controls its speed. Fans have been incorporated in bowls of flowers for use on the table or in conjunction with table lamps, thus distributing a pleasant coolness around the table. The types of fan shewn are some of those made by Messrs. Simplex Co., and by the General Electric Co., of London; other makers being The Westinghouse Co., of England and America, The General Electric Co., of America, and many others.

Adjustable Bracket Fan.

Air Purification. Ozone is one of nature's most effective methods of air purification. The air of the seashore and the mountains is pure and wholesome, attributed largely to the purifying qualities of ozone generated by natural agencies.

Breathing, cooking and manufacturing processes contaminate the air upon which we exist. Ventilating systems are partially effective in ameliorating the vitiated air. Supplement the ventilation in your home and office with ozone, a powerful oxidizing agent, which will destroy odours from cooking, tobacco, and other causes of air contamination, and you will make your air comparable with that of the sea coast and the country.

Ozone is a combination of oxygen in its most active state.

The Vohr Household Ozone Generator.

An appreciable excess of ozone is indicative of atmospheric purity. This condition is readily obtained by the use of an Ozonator. This is a simple piece of apparatus for producing ozone electrically by passing air between the blue electric zone. Many of my readers have seen the large ducts which have been installed at the Electric Tube Railways. These carry quantities of ozone for purifying the air in tunnels, passages and stations, a scheme which has proved most satisfactory in improving the atmospheric conditions underground. Similar equipments are installed nowadays in theatres, picture palaces, hotels, factories, and other places where the air is apt to become contaminated.

Portable Ozone Apparatus. Domestic ozone generators are made by the Hudson Ozone Machine Co., New York City, in America, and in England by Ozonair, Ltd., Victoria Street, London, S. W. The Household Ozonator has been designed to meet the various conditions found in residences and is ideal in every detail for household adaptation. A switch provides an excellent means for controlling the quantity. In the bedroom for instance, the device would be operated on low output, while, in the kitchen, where strong odours emanate from cooking, etc., the maximum output would be used for, at least, brief periods. It can readily be attached to any electric-light socket and consumes little power. It is strongly built and handsome in appearance.

Portable "Ozonair" Generator.

The Ozonair Company's alternating current apparatus consists of a circular moulded cast-iron base on which is mounted

the transformer, the ozone generator being arranged on a frame above the transformer. These parts are surrounded by a sheet metal cylinder with ornamental perforations surmounted by a circular moulded cast-iron top, with handle. The case is enamelled, and has a neat appearance. The base is fitted with a 3-point regulator in the primary circuit, the lever of which protrudes through a slot in the edge. The functions of this switch are as follows:

Position 1. Ozone, weak.
Position 2. " medium.
Position 3. " strong.

The size shown is suitable for purifying the air in living rooms, offices, etc., under the conditions mentioned above. It is also specially suitable for deodorising kitchens, lavatories, basements, passages, smoking rooms, etc.

"Ozonair" Apparatus for Alternating Current.

The continuous current form consists of a square cast-iron base with chequered top, standing on four small ornamental feet, the whole enamelled black and gold lined. On the top of this base is mounted the fan, the $9\frac{1}{2}$-inch blades being efficiently protected by a strong wire guard.

The ozone generator with transformer and a resistance for reducing the speed of the fan are contained in the base. The ozone generator is fitted in a special compartment, with the air inlet and outlet provided with shutters. The inlet is also provided with a renewable metal gauze air filter. Behind the fan pedestal are mounted two cartridge fuses (one for the motor and one for the ozone generator), and between these a four-way revolving-action switch. The functions of this switch are as follows:

Position 1. Fan only.

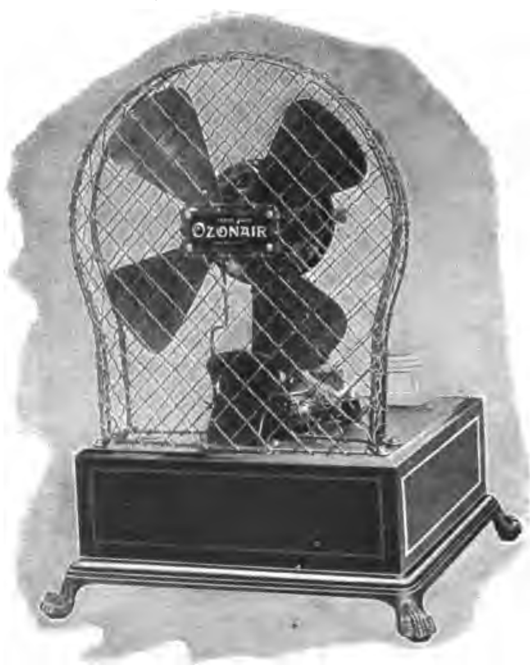
Position 2. Fan at full speed and ozone strong (this movement opens the shutters).

Position 3. Fan at half speed and ozone weak.

Position 4. Off (this movement closes the shutters).

The whole apparatus is very solidly constructed. The fan moves a large volume of air, so that these types will take the place of the ordinary fan apart from the value of the ozone produced.

These machines are suitable for purifying the air in any large rooms, offices, etc. They are also specially suitable for ships' saloons, railway carriages, etc.



"Ozonair" Generator for Large Rooms.

ELECTRICITY FOR MEDICAL PURPOSES

The applications of electricity to medical uses form an important branch of the industry, but they do not come within the scope of this book except as regards those appliances designed for home treatment. The use of the "X" rays and high frequency discharges in the location of foreign matter in the body, and the cure of diseases has made more easy the work of the surgeon, and enabled cures to be effected which previously were regarded as beyond human power. The modern dentist would be unable to do his work satisfactorily were it not for the many delicate electrical devices which have been invented for dental application, while in the hospital and in the surgery of the up-to-date practitioner, electricity is relied upon largely for alleviating the sufferings of humanity and preventing the spread of disease. In the home there are many uses for electricity in the treatment of minor ailments, and in keeping the members of the household "fit," and some of these I propose to refer to briefly. I should like to warn my readers in this connection, however, against the many electric belts, rings and so forth which are freely advertised as curing all and every disease to which flesh is subject. These are in every case absolutely useless; they have been exposed on many occasions in the technical press and by the medical profession. Testimonials of supposed cures by their aid may often be seen among the advertising matter sent out by venders of quick remedies, but where any benefit has been experienced, it has been due to the faith of the user, not to any electrical action which a body battery or electric ring could originate in the wearer. Any doctor will confirm my statement and condemn such rubbish in stronger language than I have done. Electricity in connection with the human body will no doubt be the subject of much research later.

Radiant Heat Baths. The Greeks and Romans were famous for healthy bodies, and founded a type of beauty which has become traditional. Everything that was possible at that time was done for the sake of mental and physical efficiency, and foremost amongst all other methods was the bath. They realized from experience that heat baths made them fresh and vigorous after exertion. They found that the practice of taking heat baths rejuvenated the tissues, assisted the circulation, and gave them that which they were always seeking—health. Their existence and prosperity depended upon their ability to defend themselves against enemies. They made themselves strong and at that time invincible, and they considered heat and sun baths the best methods of obtaining this happy state.

Physical fitness is as important to-day as it was then, and doctors agree that electric heat and light baths strengthen the tissues of the body, purify the blood, and bring about a condition of physical and mental efficiency which could not otherwise be attained.

A slight consideration of the training methods adopted for athletes and even for racehorses, shows that one of the first principles is to open the pores of the skin by means of constant exercise and massage in order to rid the body of impurities. This can be done most effectually by means of radiant heat baths, in which heating lamps such as are used with luminous radiators, are fitted inside folding or fixed cabinets, and controlled by switches within reach of the user, who sits inside, with the cabinet closed and covering the body with the exception of the head. By the use of these baths at home, aching limbs become a thing of the past, and the user always feels " fit " and at his best. There is nothing to go wrong, there are no complications, you merely sit in the cabinet, close the door at top and switch on the lamps, and enjoy a luxurious sun bath. The Dowsing Radiant Heat Co., are the pioneers of these electric sun baths, and the accompanying illustration shows one form in which they are made. This cabinet allows the user to recline in the bath, but other patterns have a chair in which he sits. There are 8 heating lamps inside, taking two units, and costing 2d. or 4 cents an hour to run, although the bath is not usually kept in use for many

minutes at a time, so that the cost of each bath is a fraction of a penny.

Powerful heat and light rays can be applied to the body in this way for the cure of various diseases such as rheumatism, gout, sciatica, lumbago, etc. The apparatus is only used in these cases under medical advice, of course. Dowsing's have quite a large medical institution in London, where radiant heat

"Dowsing" Radiant Heat Bath.

is administered, and they have upwards of one hundred licensees in this country and abroad who give the treatment according to prescription. These cabinets are most carefully designed for their special purpose, and a considerable number of these baths are purchased yearly by private people, in order that they may have the equivalent of a Turkish bath in their homes, with the added tonic effect of the light rays. The company also make and supply electrical medical apparatus of many kinds, such as hot-

air douches, heating pads, sterilisers, and many other appliances required in the medical applications of electricity.

Electric Vibrators. A very useful machine for giving vibro-massage to the face, scalp and body is the electrically operated pattern I here illustrate. It can be run from any electric light fitting, and weighs but a pound or so, being made in spun alu-

Electric Vibro-massage Machine.

minium. A box is supplied to contain the various applicators used with it, these being suitable for the numerous massage operations usually carried out. Needless to say, the electric vibrator is infinitely superior to the heavy, laboriously hand-driven vibrators which have been up to the present the only machines available for the purpose.

A smaller vibrator is also sold for Beauty massage and manicure, a very useful addition to the dressing table.

SUNDRIES

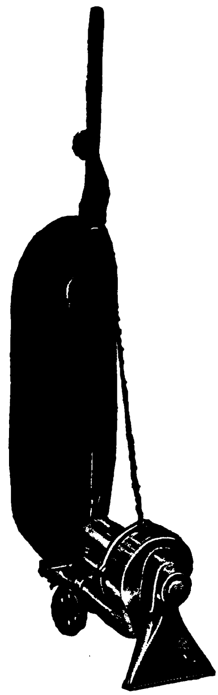
Hair Drying by Electricity. It is always a tiresome business to dry one's hair or that of one's children after washing. Rubbing with a warm thick towel removes most of the surface moisture, but the hair remains damp even after prolonged and vigorous friction, and recourse must be made to the fire, with an element of risk also. Fortunately it is now possible to dry the hair quickly, thoroughly and in comfort, by using the electric hair-dryer I show in the accompanying illustration.

The action is dependent upon a small fan motor which blows a current of air through a tube containing an electric heating unit, so that by turning a switch mounted on the heater, a draught of hot or cold air can be obtained as required. The

" Prometheus " Curling-tong Heater.

hair dryers consume only about one-half of a unit per hour, costing ½d. or 1 cent, and are intended for connecting up to ordinary house lighting circuits, a length of flexible cord being supplied for this purpose. The device weighs only 2¾ lbs. and is totally enclosed, finished in nickel with black polished handle and switch cover. Apart from its use in the home this apparatus is eminently suitable for use by hairdressers, medical men, and hospitals. It is a boon to photographers for drying quickly their negatives and prints.

Sweeping and Dusting. One of the greatest difficulties in the house is to *keep out dirt and dust.* In order to have fresh air, windows must be kept open as long as possible. Whilst windows and doors are open, particles of dust are carried in and deposited on the furniture, walls, floors, curtains, etc. The largest amount of dust is produced and distributed throughout the house by the kitchen and sitting-room fires, and by the carrying of coals and ashes. More is brought in from the street and garden on boots and clothing, while the wear and tear of carpets, curtains and so forth, and the crumbs, etc., from the table, add materially to the total of dirt which needs removal. In the past, the broom, dusting brush, and cloth have been in daily use in stirring up this dust, and collecting as much as possible of it in the dust-pan. Instead of really collecting the dust and getting rid of it, only a very small percentage is collected; the rest has simply been stirred into the air and *transferred* from one place to another. During the process of settling (which really takes several hours) one has to breathe air which is heavily laden with dust and other impurities. After the sweeping, the furniture has to be dusted, but the walls, ceilings and curtains remain covered with the dust, which increases daily until the room is thoroughly turned out for the monthly or annual cleaning. What a terrible accumulation of dust and other impurities there is at the back and on the top of a piece of furniture which has been left unmoved for a month or two! On the walls, behind pictures, etc., dust and dirt reign supreme. Disease germs abound. There is endless work for dust-pan and brush. With the advent of art floor coverings, and noiseless carpet sweepers,


The "Magic" Suction Cleaner.

some improvement was effected, but still the dust was stirred up, and the disease germs allowed to deposit themselves in another part of the room.

All this is now altered, thanks to the "Electric Suction Cleaner." By attaching the connector on the flexible wire of the cleaner to the lamp socket or wall plug (which can and should be fitted in every room) and turning the switch, the device is set in motion, and the dust is sucked out of the floor coverings, walls, ceilings, handings and furniture into a dustproof bag, which can be detached and carried away right out of the house and emptied.

The nozzle of this electric cleaner slides gently and easily in any direction, or in any position, and what has hitherto been strenuous, hard labour, now becomes quite a fascinating occupation. Furniture can be thoroughly cleaned just where it stands; heavy carpets and rugs are not only cleaned but are renovated and preserved at one operation. The tube can be pushed behind heavy pieces of furniture. Books, papers, etc., can be freed from dust without removing them. In fact, all cleaning is done *better* than it has ever been done before, and in a fraction of the time. An electric suction cleaner can be operated by a child, it can be carried from room to room and used anywhere, provided a supply of electricity is available. It is no noisier than a carpet sweeper, and does not injure the most delicate fabrics. In fact it improves carpets and upholstery, restoring the pile and bringing up the faded colours and patterns. The "fluff" seen in the carpet sweeper after use is not met with to anything like the extent in an electric cleaner, for much of this "fluff" is the actual material of carpet or upholstery, torn away by the brush. The electric cleaner sucks up the dust from the innermost recesses of the carpet and curtains without destroying or injuring them to the slightest extent. Its cost is but a fraction of a penny per hour.

Permanent Installation of Electric Cleaning. Most houses will, in the near future, have an Electric suction apparatus fitted in the outhouse or basement, with pipes which will be carried through the house with connecting points in every room or at the doors for the attachment of the suction or blowing tube.

Removing Dust from the Wall.

Wires will also be run from the cleaner to controlling switches fitted at the various connecting points, so that by attaching the suction cleaning tube at any connection on any floor, or in any room, the switch may be turned on and the suction cleaner do its work, drawing all dirt and dust down the tubes to the basement or outhouse. These permanent installations will be the most economical method for all cleaning purposes; the same motor may be employed for the various other purposes herein described.

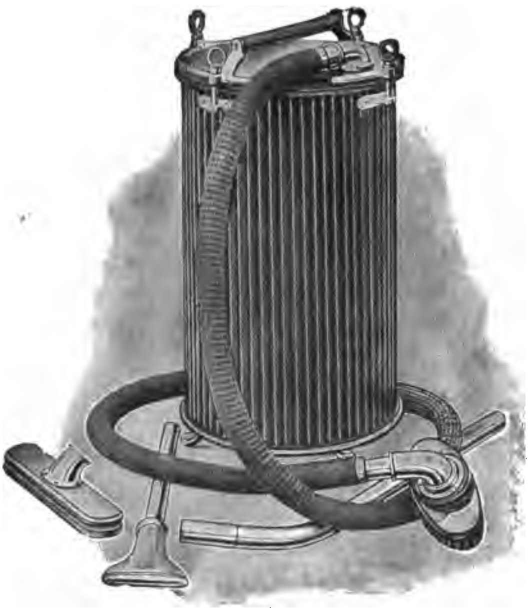
Semi-portable Electric Cleaners

The "British" Electric Vacuum Cleaner. To operate the British Electric Vacuum Cleaner, simply push in a wall plug, or remove an electric light bulb and insert in its place the adaptor at the end of the flexible wire connected with the machine. Turn on the current and the cleaner is ready for work. The length of the flexible wire, together with that of the suction tube, is ample to permit of the free and unencumbered movement of the operator in every part of the room. Not a crevice, not a single inch of space upon walls, floors or ceilings, or upon the surface of any exposed object in the house, is beyond the range of action of the British Vacuum Cleaner. You no longer need employ outside help when dirt, dust and germs have accumulated far

The "British" Suction Cleaner, Latest Pattern.

beyond ordinary methods of removal. A few minutes each day—or a few hours each week—with the Electric Cleaner will maintain your home throughout in a state of absolute cleanliness.

One of the most valuable and convenient appliances is the brush attachment in use in the illustration. It consists of a rim of pliable bristles surrounding the mouth of the suction implement. This brush implement quickly removes all accumulations of dust and dirt from cornices, wood work, pictures, picture moulding, and other surfaces difficult of access. Under the old system of house cleaning, this class of work was necessarily imperfectly done, and then only after much unpleasantness and inhaling of dust and germ laden atmosphere. In a few weeks, the same unhappy task faced you again. With the aid of the Electric Cleaner and the implement described above, all these surfaces and objects can, at the expense of little time, and with practically no trouble, be kept constantly bright and clean.



The "Wizard" Suction Cleaner. (Westinghouse Co.)

The "Wizard" Electric Turbine Vacuum Cleaner. The "Wizard" is fitted with a Westinghouse Motor of $\frac{1}{4}$ h.p. and is claimed to be the most efficient machine of its size made. It will work continuously for four hours with the consumption of one unit, costing 1d. By reason of its large nozzle, the work can be done very quickly, whilst its lightness enables it to be easily and freely moved from point to point.

"Santo" Electric Suction Cleaner.

The "Santo" Suction Cleaner. The "Santo," supplied by Duncan Watson & Co., is shown in the accompanying illustration. It will be seen from this that it is cylindrical in form, the outer case covering the motor, vacuum pump and dust receptacle. It is a most compact and efficient cleaner; is silent in working, easy to run about from room to room, since it is mounted on ball-bearing castors. By its use, one maid can do the work of six, in half the time, at a cost of about one farthing or .5 cent per hour. The "Santo" can be used for blowing the dust out of articles or corners that cannot be reached by the suction nozzle.

The "Bissell" Suction Cleaner.

The "Bissell" Electric Suction Cleaner has the motor and pump mounted in a very neat case on 4 wheels of the "run-about" pattern and it is most easy to work and very efficient.

Suction Cleaner at Work.

Portable Electric Cleaners. There are several very portable and efficient electric hand machines of which the first example I give is The "Frantz."

This machine is light, being made almost entirely of aluminium. It will not get out of order easily, it is simple in construction, and will last for years. It is fitted with a revolving brush, which picks up threads and light materials, dislodges dirt that is ground in, sėparates it and throws it into the suction current A blast of compressed air from the outlet in the front of the nozzle helps this action at the same time as it renovates the floor covering and brightens it, with the double result of cleaning and vitalizing.

Its light weight—only 9 lbs.—does not demand even the slightest exertion on the part of the operator: switch on the current, then you merely guide the Machine over the surface to be cleaned.

In the above illustration I show an electric vacuum cleaner at work on a stuffed and tufted chair, the present day method of extracting dust and reviving the coverings of upholstered furniture.

A Suction Cleaner in the Bedroom.

This illustration clearly represents how the machine adapts itself to the requirements of the varied work to which it is put in the average household. The handle can be adjusted to any desired angle—sweeping under beds and heavy furniture is easily accomplished.

Confined spaces and awkward corners cleaned with the same thoroughness as flat surfaces.

The "Magic" Suction Cleaner. One of the most popular electric suction cleaners in the British market is the "Magic," made at Witton, near Birmingham, by Magic Appliances, Ltd. It is here illustrated, and it will be seen that it is mounted on small rubber-covered wheels. It is therefore very easy to use, and rolls over the floor with no risk of damage to the surface. In its latest form, a motor of extra power has been provided, thus increasing materially its sucking action. It is lightly but strongly built and is intended for everyday domestic use. Several attachments are provided for cleaning linoleum, parquet floors, upholstery, curtains, and so forth, and it will thus carry out all the dusting and sweeping of the household at insignificant cost.

"Magic" Suction Cleaner with Flexible Tube Attached.

"Diamond" Suction Cleaner. The latest and cheapest vacuum cleaner to be introduced to English users is the "Diamond," a machine of American origin. It has several novel features, as will be seen from the accompanying illustration. The nozzle is diamond shaped, and can thus get into corners which cannot be reached by the ordinary suction mouthpiece. Then again, the handle may be adjusted at any angle to suit users of various heights, or to enable the cleaner to pass beneath bedsteads or chairs. A special adapter enables the device to be used for blowing dust away from places impossible to reach with the suction nozzle, such as inside a piano action.

"Diamond" Suction Cleaner.

SOME DOMESTIC ELECTRICAL ACCESSORIES

The space at my disposal will not allow of detailed reference to anything like the number of uses to which the good fairy electricity may be applied in the home, but my readers will judge for themselves from the examples I am able to give that there is hardly any domestic duty or operation for which electricity is not suitable and will not reduce labour.

Your Sewing Machine Driven Electrically. Take the sewing machine, for instance. How tired one gets when dressmaking, working the treadle all day or turning the handle by the hour together! It is back-aching work, and many find that their strength is unequal to the strain. They have their sewing done outside, therefore, or engage a dressmaker, both expensive luxuries, and quite unnecessary if electricity be permitted to lend a helping hand. An existing machine can be adapted, without interfering with its use for foot or hand operation, if desired. All that is needed is a small electric motor fixed on the machine table or beneath it, or as with one make, attached to the machine itself in place of the hand wheel.

Almost any woman can treadle a machine to do 200 stitches a minute, and a very strong woman may be able to work at double this speed, but not for long together. With an electrically driven machine, any user, even a child, can do 1,500 stitches a minute and keep up the pace all day long if need be. The work can be handled at this high speed as easily as when doing it slowly by hand, because neither the wheel nor the treadle requires any attention. One has only to guide the material, the motor does the work. It more than trebles the output, but the user never gets tired. No more aching limbs or sprained back. It makes sewing a pastime. It is delightful, it is simple, it is certain and always the same, ready at any moment, and can be operated from any lamp-holder or wall socket at a cost of only a few pence a day. Motor attachments are manufactured by the Westinghouse Electric Company, the Thomson-Houston Company, and most of the electric motor makers, and can be obtained from any supply works.

"Singer" Sewing Machine Attachment.

My first illustration shows an electric attachment supplied by the Singer Sewing Machine Company. This consists of a Diehl motor carried on a supporting bracket attached to the framework. A brake and speed regulator are provided, so that the machine can be stopped instantaneously, or its speed varied from a crawl to the highest with which it is possible to keep pace. The existing hand wheel is connected to the motor pulley by the same round leather or gut belt which formerly joined the treadle movement to the hand wheel. The motor and all moving parts are well out of the way, and there is no risk of accident, while the arrangement does away with the somewhat unsightly appearance of a motor mounted on the top of the table. The motor runs only when the machine is being operated; there is no waste of current when the machine is idle. A slight pressure of the foot upon the old treadle starts up the machine, and the moment the foot is removed, the brake is applied, stopping the machine instantly. The speed can be varied from a few stitches a minute up to 1,000 or more.

Using a Bissell Electric Sewing Machine.

Another type of attachment is shown on the next page. This represents the outfit supplied by Messrs. Simplex Conduits, Ltd., of London, and is similar in appearance, with the exception that the motor is attached to the table, the control being effected as before from the treadle. Speed regulation is effected by pressing the treadle so as to tighten or loosen the belt, and so give a tight or loose drive, the motor in the latter

case slipping and thus turning the hand wheel more slowly. A speed regulator allowing for 4 or 5 definite speeds, can, however, be attached at a slight extra cost, the treadle being then used only for starting and stopping the machine.

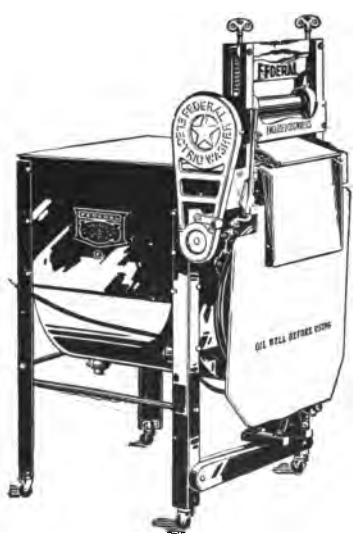
I also illustrate a system supplied by the Bissell Company, of Toledo. The driving motor is the same size as, and takes the place of, the existing hand wheel, so that there is nothing to get in the way of the work. It weighs but a few pounds,

Using a "Simplex" Electrically-driven Sewing Machine.

yet it will stand the constant wear of years, and will perform as heavy work as the sewing machine is capable of carrying out. This type of attachment has the advantage that it does not interfere with the working of a drop-head machine, but closes with it out of sight, everything under cover. The machine looks as it always did, and can, if desired, be reconverted for hand or foot working, although I am quite sure that no lady, once she has used an electric machine, would ever desire again to do the work by hand.

"Maytag" Electric Washer.

Electricity in the Scullery and Wash-house. I have already referred to some of the domestic applications of electricity, but there is no department of home life in which it may not give a helping hand. We have seen how it lightens the work of the cook and the housemaid, and we shall now see how the laundry and scullery maids may benefit by its assistance. In smaller households where no helps are kept specially for washing up and for laundry work, electrically heated and operated apparatus lightens labour and does the work more quickly and thoroughly than is possible by hand. In America the electric washing machine has been developed to a much greater extent than in Great Britain, but its use is now gaining ground, and when its advantages are realised, no housewife will rest till she has added one to her domestic equipment.



"Federal" Combined Washer and Wringer.

The "Maytag" Clothes Washer. In the illustration I show the "Maytag" washing machine, which has lately been introduced in the English market by Messrs. E. C. Seear & Co., Devonshire Square, London, E.C. It comprises a washing tub and double wringer, driven by a small electric motor underneath, the whole being supported on legs with castors so that it may be wheeled about or put away when not needed. It may be

connected in a moment to any wall socket or lamp holder by means of flexible cord and an adapter, and the cost of running is less than 1d. per hour (2 cents). It will wash thoroughly a tub-full of clothes in five minutes without damage to delicate fabrics.

" Apex " Washer and Wringer.

The introduction of the electric clothes washer vanishes for ever the dread of wash-day, the weekly incubus of so many housewives. It is so simple to use, so quick in its action, so thorough in the execution of its duty, so cleanly in its methods and so great an advance generally upon the old-fashioned wash-tub that no up-to-date household should be without one. There is another point which is worth mentioning. The large number of laundries which have sprung up within the last few years owe their prosperity to the disinclination of ladies to have their washing done at home. Under present conditions this is not perhaps remarkable, but with the electric clothes washer, followed up by the electric flat-iron, there is no reason why the domestic wash should not be a pleasure rather than a dread undertaking. With clothes properly washed at home, there is no risk of contamination, and the linen and damask, the underclothing and flannels, are less likely to becone damaged, home-washed

Electric Ironing after Electric Washing.

clothes being cleaner, whiter and sweeter than is the general experience with those returned from public laundries.

Another pattern of domestic washing machine is that made by the Federal Sign System, 229, West 22d Street, New York, and

When Traveling, take your Electric Iron with you.

shown in my second illustration. It is mounted on castors, and occupies little space, while it can draw its supply of current from the nearest electric light pendant or wall socket. The miniature motor fixed underneath, drives both the cylindrical oscillating tub and the reversible wringer on top, the cost being only 1d. per hour or 2 cents. All gears and moving parts are

protected by a metal shield so that there is no risk of accident. The "Federal" washer will do in two hours the washing which hitherto has required a whole day, and do it better and with less mess and fuss.

Another combined electric washer and wringer of American origin is the "Apex," supplied by the Electric Shop, 33d Street, at Madison Avenue, New York. This is made in sizes for domestic and commercial use, and washes by suction. It will wash perfectly such articles as wrist and collar bands as well as the heavier flannels and linens, and while hard on dirt is easy on clothes. It does the washing and wringing simultaneously, so that by the time the last lot of clothes is being washed, those which have been through the machine are quite or nearly dry on the line. The "Apex" is of metal throughout, with no gearing to catch one's fingers or tear one's clothes.

Ironing a Pleasure.

The Shannon Manufacturing Co., 124, Lexington Avenue, New York City, also make an excellent electric washer and wringer, for domestic and laundry use, two sizes and several patterns being listed.

Ironing by Electricity. After the clothes have been washed, they need ironing, and my readers will bear me out when I state that few domestic duties are more tiring or more exacting, or involve worse discomforts, particularly in the warm weather. It seems impossible to alter these conditions, yet those who have once tried electric irons have found by experience that they make ironing a pleasure rather than a drudgery, and that in the hottest weather the electric iron may be used with comfort.

It heats up quickly; it remains hot for as long as may be required; not too hot for any risk of scorching nor too cool to deal with very damp material; its polished working surface is always

clean and bright; its handle never gets heated, so that no iron-holder is needed or any protection against burns; it can be used in the kitchen, on the sitting-room table, in the bedroom or in any place where there is an electric fitting; and it throws out no heat but on the work to be ironed. With the electric iron there is no risk of iron-mould or dirty marks on the linen; there

Enjoyable Minutes with an Electric Iron.

is no delay while waiting for the iron to heat up or cool down, and no changing of one iron for another when the first becomes too cool for any good. Since it maintains a steady heat all the time, ironing can go on without interruption and the work is finished quickly, while its uniform temperature means that the whole of the work is done equally well.

Because an iron is heated electrically, it does not follow that it is heavy. An electric iron for lace work may weigh only $2\frac{1}{2}$ or 3 lbs., but the average weight for domestic work is from 5 to 6 lbs. As it has not to be lifted about, but merely slides over the work, it is easier to manage than an iron heated over the gas or coal fire, for with the latter it must be carried to and fro many times an hour between the ironing board and the stove. A heavy iron will do the work more quickly and satisfactorily than a light one, and if ladies would only experiment with a heavier iron than that to which they have been accustomed, they would be agreeably surprised at the result, and the absence of effort needed with an electric iron.

Smoothing irons are made in scores of weights and patterns for every conceivable purpose, from the miniature silk-hat iron weighing but a few ounces to the power-driven skirt or goose iron for laundry work weighing upwards of 40 lbs. In laundries the shape of irons differs very materially from domestic practice, and few of my readers would recognise some of the patterns as being irons at all. For example, electrically heated "bolts" and goffering irons are of tubular form with rounded ends, used for smoothing tucks and getting into corners, as well as for goffering proper. Skirt ironers comprise electrically-heated cylinders, resembling wringing machines on a large scale, through which the skirts are passed, the drums being driven by an electric motor.

As this book deals chiefly with domestic applications of electricity, I will merely illustrate one or two patterns of domestic irons, but my readers will appreciate that these are but a few out of the many types which can be bought at any electrical dealer's.

The "Eclipse" domestic iron is intended for light duty and weighs but $3\frac{3}{4}$ lbs. It takes 350 watts, and costs, therefore, just over one-third of a penny per hour to run, or less than a cent. It is nickel-plated all over, with large heat-insulated handle, comfortable to hold even for long periods. A spiral tube of steel wire projecting from the detachable china connecting block at the back, protects the flexible wire from damage and keeps it clear of the work. This and many other

Simplex 6-lb. Iron.

patterns of domestic and laundry irons are made by The Electric and Ordnance Accessories Co., Ltd.

The "Simplex" flat iron weighs 6 lbs., and takes 450 watts, the running cost being less than ½d. an hour or 1 cent. This is a heavier iron, suitable for the average class of ironing, and it will deal with damp clothes without cooling down. It is fitted with a marble connector and short piece of flexible metallic tubing, to protect the flexible wire and keep it out of the way.

The British Prometheus Co., Birmingham, makes a large range of domestic and laundry irons. The heating elements in Prometheus irons consist of thin films of an alloy of copper, gold and platinum on a mica base, which is practically indestructible in normal service. In other makes of irons, the element is a fine nichrome wire wound specially over flat strips of mica laid close to, but insulated electrically from, the sole. Most irons are guaranteed for at least a year, but I have had irons in constant use for 4 and 5 years which are still running satisfactorily with their original heating element. In time, of course, these elements will break down, and makers, recognising this, are now designing their irons so that a new element can quickly be inserted by any user, the sole piece being removed by taking out two or three screws, thus exposing the heating element. Renewals cost but a few pence.

An excellent iron is the "Hot-point," made by Eastman & Warne, of Acton Vale, London. This is formed inside with a number of slots, into which the thin heating wires wound on flat uralite strips, are inserted. This construction distributes the heat evenly over the whole of the working surface, including the sharp point or nose, which with some electric irons is apt to cool down quickly when the iron is used with wet clothes. With the "Hot-point"

British "Hot-point" Domestic Iron.

" Magnet " Electric Iron.
(G. E. Co., England).

A Siemens Iron for
Domestic Use.

iron, no such possibility exists. There are the G. E. C. irons, and others too many to mention here.

In England, it is not customary to employ switches or heat regulators in conjunction with electric irons, but in America these are frequently met with, and have several advantages. Different classes of material need varying degrees of heat, and although the conditions can be met by employing two or more irons with different loadings or current consumption, it is convenient to be able to run a single iron at varying temperatures and to control it by a switch mounted on the iron itself.

Electric Irons in the Tailor's Shop.

Electric Iron with Three-heat Regulation.

An iron with three heats made by the Current Electric Co. Chicago, and weighs 7 lbs. Heat regulation is effected by varying the position of the asbestos plug at the back, which makes contact with three pins connected inside to the heating element. The "high" or intense heat is intended for dealing with heavy damp work, the "medium" heat for average duty and the "mild" heat for ironing properly small and light articles. Other excellent irons on the American market include the "Simplex," made by the Simplex Electric Heating Co., Cambridge, Mass., with automatic regulator for cutting down the current consumption when the iron is not in use, but is placed on its stand; the Universal, the "Hot-point," in the 3-lb. domestic model, is guaranteed by the Hot-point Electric Heating Co., Chicago, for ten years; the "Lektrik" made by the Western Electric Co., New York; the G. E. iron of the General Electric Co., of America; and the "Acme," designed by the Acme Electric Heater Co., Detroit, Mich. The Western Electric Co., offers an iron which can also be used for heating curling tongs or goffering irons.

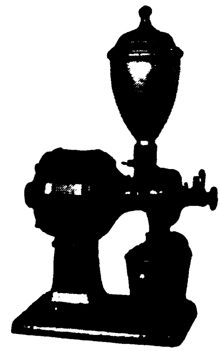
Prices of electric irons vary according to the weight and finish. In England, the cheapest iron is listed at 9/6, the average price for a 4 or 6-lb. iron, nickel-plated, being 12/6. In America, a 3-lb. iron costs about $4, but if with heat regulation, the price may be as much as $8 to $10 for a 6-lb. domestic iron.

Prometheus Universal Voltage Iron. When a lady has once become used to the convenience of an electric iron, she is never content to put up with the dirt and trouble of a gas-heated iron, or one placed over the kitchen range.

When staying away from home, however, in a hotel, in apartments, or with friends, she is deprived of its use, although there are many little items of finery and of clothing which need the assistance of the iron while away from home. It is useless, as a rule, taking her own iron away with her, for as likely as not, the voltage or pressure of the electric light supplied at the various hotels or houses at which she stays, will differ from that at home, while even if this were not so, she deprives those left at home of one of their greatest comforts. To meet such conditions, the British Prometheus Co. has introduced an iron that may be used, by altering the position of the connecting block at the back, with any electric supply at voltages between 100 and 250. The iron weighs about 3 lbs. and takes only 250 watts, costing, but $\frac{1}{4}$d. or .5 cent per hour to run. It is packed in a box complete with length of flexible cord and adapter for connecting to any lampholder, and is a most convenient addition to anyone's travelling kit.

"Prometheus" Traveller's Iron.

Coffee Grinding and Food Chopping by Electricity. In households where a large quantity of coffee is used and where freshly-ground berries are appreciated, an electrically-driven coffee grinder is indispensable. The machine illustrated occupies little space, is most handsome in appearance, and yet will granulate 2 lbs. of coffee per minute or pulverise ½ lb. in the same time. It takes a ¼-h.p. motor, costing to run about .3d., or under 1 cent per lb. Larger or smaller machines are made, the pattern illustrated being of sufficient capacity for the largest residence, but too small for hotel or restaurants of any size. The second photograph shows a combined coffee-grinder and meat chopper. This fixes on to a bench or table and is driven by a ½-h.p. motor, costing less than a penny or two cents an hour to run. It will pulverize 1 lb. of coffee per minute, or granulate 3 lbs. in the same time; and as a chopper, will mince 5 lbs. of meat per minute.

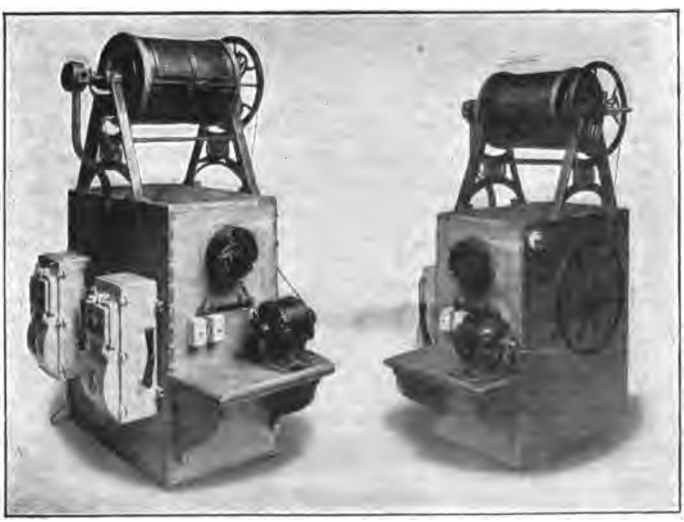


"Universal" Coffee Grinder.

Electric Coffee Roaster. There is more science in the preparation of coffee than the average householder is inclined to acknowledge. Coffee, to be tasted at perfection, should not only be freshly ground, but it should be freshly roasted also. As soon as the roasting process is completed, the coffee should be cooled as quickly as possible, and the roasted berries kept from contact with the air, and ground immediately before use. Roasted coffee berries soon deteriorate, lose their flavour, and impart a bitter taste to the decoction. Good fresh coffee is a digestive, but stale and bitter coffee is unpleasant and indigestible. Coffee can be prepared in many ways, but by far the best method is by the percolation pro-

"Universal" Combined Coffee Grinder and Meat Chopper.

cess, and no one who has tasted the beverage poured out from a percolator will ever care for coffee made by any other method. The roasting process is best carried out electrically, for the same advantages apply to coffee as to meat. Coffee berries subjected to close contact with gas flames naturally absorb some of the unpleasant and perhaps poisonous fumes which accompany gas combustion, whereas when roasted electrically the process is completed in a pure atmosphere of heated air. Coffee experts are unanimous in their opinion that electric v. gas roasting can only be compared with coffee made with cream or with milk. The accompanying illustration shows an electrically driven coffee roaster. It is driven by a one-sixth h.p. motor, which operates the drum at the correct roasting speed, and drives an exhauster-cooler for removing the dust from the roasted berries and reducing their temperature. The drum has a capacity of 7 lbs. of coffee, and will roast ½ cwt. of berries per hour. The heating unit is in the centre of the drum, and is of the Purcell & Nobbs immersion type, rated at 4.5 kw., and provided with heat regulation so as to give the required colour to the berries, and to adjust the roasting temperature.



Electrically-heated and Driven Coffee Roaster.

The cost of the operation is about 5 or 10 cents an hour at full heat, including the current taken by the motor, but in practice the machine is only needed for a few minutes daily. This machine is intended for use in restaurants, hotels, and shops, but smaller sizes are made for domestic applications. The 1-lb. model is suitable for roasting any quantity from an ounce to a pound, the energy consumption for the latter quantity being only .25 unit. Subsequent charges, if roasted immediately afterwards, take less current still, the machine being already hot. Small machines are hand-driven, but are electrically heated, and a large tray is provided for cooling the berries.

The Electric Dish and Plate Washer. Washing up is almost a continuous business in many households, and an unpleasant drudgery it is. There seems no end to the number of plates, dishes, cups and saucers, knives and silver articles which require cleaning during the day. Nowadays a mistress employing only one maid often has to do the washing up herself when without help, and no household duty is so distasteful. In a large establishment the scullery-maid finds it as much as she can do to get through with the washing up between meals, even if this be her only work. It is possible, however, to wash up everything but saucepans and the like by the aid of an electric dish washer, and to do the work more quickly and thoroughly than by hand. Such a machine is here illustrated, although the pattern shown is larger than would be required in an ordinary household.

The apparatus consists of two or three vessels, the first for washing in water at 100° F., the others for rinsing and sterilizing in hot water at 160–212° F. The perfect washing accomplished by this system is due to the water being discharged from above at a very high speed over the dishes, which are firmly packed in a basket placed on a revolving bedplate. This water is filtered and forced over the dishes repeatedly with great speed, thoroughly washing them in half a minute. The same water can be ueed for two or three hours. All sorts of utensils can be washed: plates, knives, forks, spoons, silver, cups, glasses and dishes.

The baskets are then rinsed in the hot clean water in the rinsing-cisterns, which like the washing-cistern are provided with

a lift arrangement which is very easily managed. The grease rinsed off in the hot water is skimmed off by a particularly effective arrangement of a fanshaped water jet placed opposite a wide outlet. The motive power is provided by an electric motor, the heat for the water being obtained by means of electrical resistance elements or by a fire.

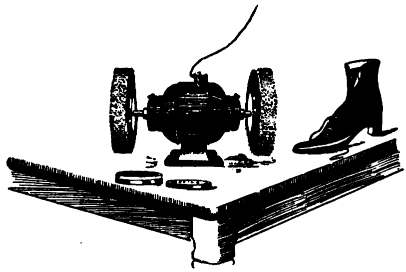
"Cornhill" Plate and Dish Washer, Electrically Driven and Heated.

The whole of the apparatus is manufactured from the strongest and most serviceable material and easily managed by one attendant. The cost of running is by no means great, but varies with the size of washer. If the water is heated electrically, the total cost works out at something like 2d. or 4 cents per hour.

The Electric Maid-of-all-work. There are many operations in the kitchen involving a rotatory movement, such as knife cleaning, mincing, ice-making, coffee grinding and the like. These and other machines may be driven effectively and cheaply by a small electric motor, the same motor being employed for all, suitable couplings being provided for connection to the shaft of the motor. In England such universal duty-motors are not yet widely used, although they are most useful machines, and can be coupled to any standard makes of mincers, knife cleaners and so forth, so that it is not necessary to purchase new ones, but merely to adapt them for electric driving. The motor can also be used to drive a vacuum cleaner and is sufficiently light to be carried about to rooms where its services may be needed. In America, the idea has been carried a step farther, and several utensils, together with the motor for driving them, are arranged permanently on a stand mounted on castors so that it can be wheeled about and put away when not required. It will do mixing work, meat mincing, ice making, grinding, egg beating, slicing and many other duties, while it will drive a boot polisher, knife machine, polisher for silver goods and similar devices. The table measures 18″×26″ and all metal parts are heavily nickel-plated. Its use not only saves time but results in better work carried out under really sanitary conditions. The maker of the machine I illustrate, which costs about ¼d. an hour to run (.5 cent), is the Federal Sign System of New York. The motor and all the appliances fold into the table when not required leaving a handy table for other work.

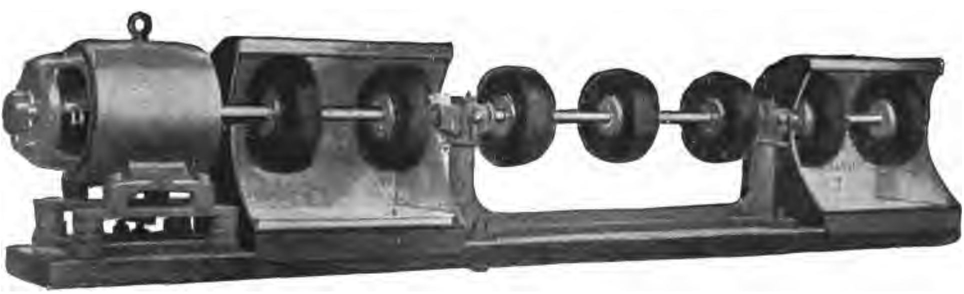
"Federal" Universal Domestic Motor.

Boot-cleaning by Electricity. In a large household an electric boot cleaner, similar to that illustrated or driven by a motor which is available for other purposes, will save the work of one or two persons, enabling a large number of boots to be dealt with



"Simplex" Boot Cleaner.

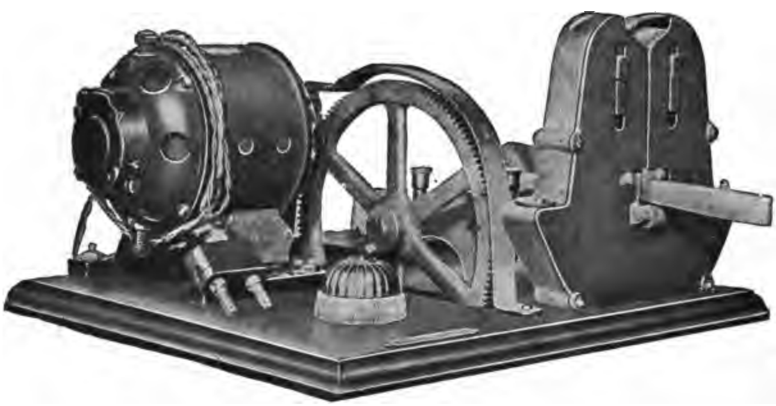
in a very short space of time. There are 2 circular brushes, one at each end of the motor spindle, for removing the dirt and for polishing respectively, the blacking being put on by hand or by means of a third brush, which can be screwed on the spindle in place of one of those provided.



Hotel Boot-cleaning Machine. (G. E. Co., England).

Knife Cleaning by Electricity. Any rotary knife machine can be adapted for electric driving, but in large households, in restaurants, hotels and similar establishments, it pays to instal a self-contained electric knife machine. There are many makes on the market, the one most frequently met with being supplied

by Messrs. Kent of High Holborn, London. It is driven by a small electric motor, and costs only about ¼d. of .5 cent per hour to run. Smaller machines for a fewer number of knives are made by Messrs. Kent, as well as larger ones for restaurant purposes. These machines save time and preserve the knives, while they clean at one operation, not only the blade, but the back and shoulders. In the larger machines, automatic control is provided, so that when the knives have been inserted, and the motor started, no further attention is needed, the machine stopping after a certain number of revolutions have been made. This ensures effective



Kent's Electrically-driven Knife Machine.

cleaning without risk of overheating the steel blades or damaging the machine through neglect to stop it. Needless to say, the electric knife polisher does its work far more quickly than is possible by hand. Another useful form has rubber wheels for cleaning, and a wheel for sharpening; the knives being put in while the machine is running. This is also used for cleaning silver, etc.

Polishing Silver Goods. Those who possess a large quantity of silver plate appreciate the work entailed in keeping it clean. In restaurants and hotels the problem is a much more serious one, of course, for guests insist upon the use of silver or plated vessels

and these must always be bright and shining. To clean them by hand entails continuous work for two or three employees, and an electric polisher saves much labour, and of equal importance, removes less silver in the cleaning process. An electric polisher occupies little space, takes but a small motor to drive it, and costs only a fraction of a penny per hour when in operation. The pattern I illustrate is suitable for the largest residence or for small restaurants and hotels.

Electric Potato Peelers. Except in the largest households there are not sufficient potatoes used to justify the adoption of an electric potato-peeler, but in large establishments and in

Cleaning and Polishing Machine, for Knives, Forks and Silver. (G. E. C. of England.)

restaurants, such a device is particularly useful, and not only saves much time, but peels the potatoes with less waste than is usually the case with hand peeling. The potatoes are placed in the machine just as they are bought, and when the motor is started, they are subjected to a scraping action by means of rotating roughened surfaces, and this removes every particle of skin without wasting the potato itself. It is not possible to get out the "eyes" in this or in any other mechanical way, but it is simple enough to remove them by hand with a special tool made for the purpose. I illustrate a potato peeler suitable for the largest households or for small hotels. the driving agency

being a $\frac{1}{4}$-h.p. motor, costing little more than $\frac{1}{4}$d. or .5 cent per hour to run. This machine will peel 50 lbs. of potatoes in a few

"Cornhill" Electric Potato Peeler.

minutes, and it is not therefore needed for long periods, unless, as in a restaurant, meals have to be served continuously throughout the day.

Ice-making and Refrigeration. In America every household has its freezer for making ice-cream or for producing ice to keep food cool, and prevent milk and other liquids from deterioration. In England the weather is seldom hot enough for many days together, to justify, in the opinion of most housewives, the expense of a refrigerating outfit. Yet food preservation and the making of cooling drinks cannot be done effectively or at small cost if ice has to be bought every day in the Summer, nor is the latter method satisfactorily. A small ice-making plant can be bought for a few pounds and will prove extremely useful, while in the smaller households a freezing machine, elec-

" Federal " Domestic Freezing Machine.

trically driven, will save much work when ice-cream is required during the Summer. The machine illustrated has a capacity of 3 quarts of ice-cream, and costs $\frac{3}{4}$d. or 1.5 cents an hour when in operation, although it is seldom wanted for more than half-an-hour at a time. A larger equipment is supplied for ice-making and is suitable for a large house or small hotel.

Electric Glue Pots and Sealing-wax Heaters. Although not an every day requirement in the house, the electric glue pot is a most useful device. In the amateur workshop, it is invaluable for picture framing, cabinet work and any class of woodwork,

Electric Glue Pot.

while for repairing all sorts of household utensils, furniture and the like, there is nothing so convenient or so reliable. It will heat the glue without risk of burning, the glue is always at the right consistency, and it can be left with the current on indefinitely without damaging the contents or the vessel itself. Although many electric glue pots have an outer vessel containing water, a jacketed utensil is not really necessary, for the heating effect is so steady that there cannot possibly be any undue rise in temperature. If the vessel be of aluminium the glue will not adhere to the sides, so that there is no waste, and even if current be left on so that the glue cakes into a solid lump, the addition of water will restore it to its original condition. Three heats are usually provided, full heat for melting the glue quickly, and the lower heats for maintaining the liquid at the correct temperature. The cost of operation is less than 1d. or 2 cents for a couple of hours at full heat, and much less at the lower heats.

Sealing-wax heaters are not perhaps of use in every household, but they are most convenient for sealing up parcels and for other purposes. They are automatic in action, so that there is no waste of the wax, and they are absolutely free from fire risk, an advantage possessed by no other form of heater. In view of the danger of the gas-heated sealing-wax melter, its use is, I understand, prohibited in some factories in England. Many fires have been caused in this manner, particularly in places where celluloid and similarly inflammable materials are used.

Electric Glue Pot. (G. E. Co., America).

The amateur woodworker need not be afraid of using an electric glue-pot or sealing-wax heater in his workshop, even if they be surrounded with shavings. The illustrations show one or two varieties of glue-pots and sealing-wax melters which are on the English and American markets.

Electric Soldering Irons. Another useful accessory for the amateur mechanic and for general domestic repair work is the electric soldering iron. Electrically heated tools present many advantages over older types of stove- or gas-heated devices, the greatest of which lies in an increased output combined with a saving in labour. No time is lost due to changing irons, for the

Electric Soldering Iron. (G. E. Co., America)

heating is continuous and uniform, and the tool is always at the critical temperature necessary for quick and perfect soldering, branding or burning. Consequently the user's time is saved, and the work is done both more quickly and with greater satisfaction. An advantage peculiar to the electric iron is that it can be used out-of-doors, since it cannot be affected by draughts or wind, as in the case with gas or spirit-heated irons. The cost of operation is but ½d. or 1 cent per hour, the cost of each job being but a fraction of this, for the iron heats up in a few moments, and is seldom needed for many minutes at a time. I show a typical iron for domestic use made by the General Electric Company in America.

WHAT ELECTRICITY CAN DO

Some Special Heat Applications of Electricity for Industrial Uses

Glove drying for shipment.
Rubber tyre making for omnibuses, etc.
Leather tanneries.
Mosquito incubator for plague research.
Poultry incubators.
Lacquer and drying ovens and tables for G. P. O.
Brass washing tanks and sawdust dryers.
Manure concentrators for oil refining and manufacture.
Glass drying tables.
Electric hot-air hydro-extractors for drying plated metalware.
Humidifying apparatus.
Drying ovens and cabinets for laboratories.
Cinematograph film drying apparatus.
Stills for chemists, etc.
Autoclaves and sterilisers for hospitals.
Apparatus for water analysis and research on distilled water.
Drying apparatus for chemical powders, pill and tabloid making.
Drying ovens for chemical laboratories.
Hot sand bath for chemical laboratories.
Water ovens for chemical laboratories.
Embedding baths.
Rectifying apparatus for alcohol, ether.
Tobacco condition and toasting tables and press.
Gold blocking press.
Branding irons.
Tempering, annealing and hardening furnace.
Combined hot air engine and pump.
Glue pots and composition melters.
Printing machine ink heaters.
Roller drying room apparatus.
Wax heaters.
Dental plate dryers.
Japanning ovens.

Three Years' Experience in Cooking and Heating in an All-Electric Home with Example of Monthly Cooking Costs. The old saying that the proof of the pudding is in the eating stands good for experiences in Electric Cooking, and the use of Electricity for Domestic purposes. I am able to give details of the actual experience of a householder who has been enjoying the advantages of Electricity for Cooking, Heating and other domestic purposes for the past 3 years.

The house is typical of those met with in any English suburb. It is rented at £60 ($300) per annum, exclusive of rates and taxes, and contains ten rooms, the largest measuring 18′×14′, those on the ground floor being 10′ 2″ high and those on the upper floor 9′ 6″. The illustrations give a good idea of the appearance of the house from the outside and one or two of the rooms. Electricity is supplied by an Electric Light Co. at 200 volts, alternating, and costs 6d. (12 cents) per unit for light and 1½d. (3 cents) for heating and cooking. These admittedly are heavy prices, but for family reasons, the householder in question preferred to live in the neighbourhood, and it is, therefore, the more remarkable that he has found it practicable to do everything electrically throughout the house. All the lighting, heating, cooking, hot-water supply, cleaning and so forth are carried out electrically, and no trouble was experienced from the first, except with a few of the early types of apparatus employed, for it must be remembered that in 1909, when the house was first occupied, very little had been done anywhere in the way of electric cooking

for an entire household. The household comprised 6 persons, with an average number of casual guests.

No coal or gas has been used in the house since 1909, and electricity has been depended upon for every operation for which it can readily be adapted. Electricity is used for all cooking, from boiling an egg or making a piece of toast to the Christmas dinner.

At the time the house was taken there were few electric ovens available, the two best known being the "Silundum" oven of the British Prometheus Co., and the domestic type of the General Electric Co., of England. The "Silundum" oven was decided upon, and was used continuously for several months, but trouble developed with the heating elements, which were not uniform in resistance, of a fragile nature, and liable to fracture at small provocation. The "Silundum" oven was of the cast-iron type, heavily lagged, without grill or hot plate, the elements being rated at 2,000 watts when at full heat and 1,000 watts at low heat,

Dining-room in the Electric Home. All the apparatus shown is heated electrically.

the running costs being, therefore, 2d. or 4 cents and 1d. or 2 cents per hour respectively. As the attempts of the manufacturers to improve the elements did not succeed it was discarded in favour of the "Bastian" *light metal* pattern as illustrated on an earlier page, and this was much more successful.

The elements are rated at 1500 watts when at full heat and at 750 watts at low heat, costing 1.5d. or 3 cents and .75d. or 1.5 cents per hour to run. The oven is quite small, and intended

Bedroom in the Electric Home.

for modest requirements, but it will accommodate easily a 6-lb. joint with a pudding as well. The early type of "Bastian" oven used gave trouble on several occasions through breakage of the wire-heating element at the points where it was clamped to the terminals on the frame. This design was improved in later models, and one of these ovens is still in use, giving every satisfaction. The oven heats up quickly and responds rapidly to changes in the temperature control; while the red glowing spirals in their quartz tubes give out a large proportion of radiant heat, which is required for some cooking processes and for browning pastry.

When the makers of the "Tricity" cooker introduced their light portable oven, my friend bought one and found it a most valuable adjunct to the "Tricity" system, which in its original form he had used from the first. Having the "Bastian" and "Tricity" ovens available he was practically independent of breakdowns, since it was unlikely that both would fail at the same time, and indeed this never occurred.

The "Tricity" cooker has been found to be most satisfactory in use. It has been worked under very severe conditions and on many occasions has been run continuously for 12 to 15 hours, for several consecutive days. Trouble has arisen, principally in the conductors carried within the flexible metallic tubing attached to the extension cookers, but since the makers adopted improved methods of insulating and protecting these wires, the trouble has not recurred, and the oven and hot plates are working every day of the week. No difficulty has been found in keeping the oven bright and clean, and notwithstanding its light construction, it has proved quite equal to the heavy demands made upon it and the somewhat rough usage to which any kitchen device is subjected.

The kitchen equipment comprised the two ovens mentioned, an additional "Tricity" hot plate and extension cooker, a "Phœnix" grill and water heater; several self-contained kettles and saucepans by the Prometheus and Eclipse Companies; "Ferranti" and "Eclipse" breakfast cookers, porringer, and other accessories. In order to secure accurate data as to cooking costs, as apart from heating, lighting and hot-water supply, a separate cooking circuit and meter were installed, and every day a reading was taken so as to note the daily consumption of current for cooking purposes. Separate meters also were installed for lighting and heating, and weekly readings taken for the purpose of comparison and checking the use of energy.

I will now give two examples of figures supplied by my friend of the many simple English dinners cooked, showing actual results in practice and the cost of electric cooking at home.

DINNER A

Weight of joint (beef) uncooked = 5 lbs. 6 ozs.
Weight of joint (beef) cooked = 4 lbs. 14 ozs.

		Watt-hrs.
Joint	Oven at full heat (1,600 watts) from 11.00 to 12.10 p.m.	1866
Yorkshire pudding	Oven at low heat (400 watts) from 12.10 to 12.55 p.m.	300
rice pudding	Oven at full heat (1,600 watts) from 12.55 to 1.45 p.m.	1333
	Total	3,499
Vegetables (potatoes and greens)	Hot plate at full heat (800 watts) from 11.30 to 12.10 p.m.	533
	Hot plate at low heat (200 watts) from 12.10 to 1.45 p.m.	316
	Total	849

Total energy consumption for dinner = 4,348 watt hrs. or 4.3 units.

The cost of cooking this simple dinner works out at 1d. per unit to 4.3d. or 8.6 cents, and the loss of weight in the meat cooked was 10.7% of its original bulk.

DINNER B gave the following results:

Weight of joint (leg of mutton) uncooked = 5 lbs. 4 ozs.
Weight of joint (leg of mutton) cooked = 4 lbs. 13 ozs.

		Watt-hrs.
Joint and two puddings	Oven at full heat (1,600 watts) from 10.55 a.m. to 11.55 a.m	1600
	Oven at low heat (400 watts) from 11.55 a.m. to 12.45 p.m.	333
	Oven (bottom heat at full (800 watts) from 12.45 p.m. to 1.30 p.m)	600
	Oven (top heat at low (200 watts) from 12.45 p.m. to 1.30 p.m.)	150
Vegetables (potatoes andsprouts)	Hot plates at full heat (800 watts) from 11.45 to 12.25 p.m	533
	Hot plate at low heat (200 watts) from 12.25 to 1.30 p.m.	217
	Total (3.4) units	3,433

The cost of cooking this meal works out at 3.4d. or 6.8 cents.

In addition, it was the usual practice to prepare sauces in a casserole over the inverted top of the extension cooker giving top heat to the oven, without using any further current, the water being first boiled on the hot plate inside the oven before the joint was put in. When the vegetables were taken off, the hot

plate was used to warm water for washing-up, by using its residual heat, no extra current being used. The cost of cooking these meals at 1d. per unit was but 3½ to 4½d. or 7 to 9 cents, figures which will bear very favourable comparison with the cost of any other method of cooking for similar meals.

It will be seen that in the second example the loss of weight was only a little over 8%, but in many other test examples the loss has been reduced to 5 or 6% only.

I am able to give an extract from my friend's log-book showing the daily consumption of current for a month for cooking. These figures are representative of those secured throughout the whole 3 years under review.

DAILY METER READINGS

SHOWING CURRENT USED FOR COOKING

Date.	Units Used.	Date.	Units Used.	Date.	Units Used.
1911		1911		1911	
November 1	5	November 11	5.5	November 21	8
" 2	4.5	" 12	6	" 22	6
" 3	5	" 13	5.5	" 23	6
" 4	5	" 14	5	" 24	6.5
" 5	8	" 15	6	" 25	8.5
" 6	4	" 16	5.5	" 26	4.5
" 7	5	" 17	6	" 27	6.5
" 8	5	" 18	5.5	" 28	7.5
" 9	6	" 19	7.5	" 29	5
" 10	5.5	" 20	7.5	" 30	6.5

From the above table it will be seen that during a complete month in the winter the cooking for the household of 6 persons was responsible for the consumption of 129 units, costing 14/11d., or $3.80 The average daily consumption works out at 5.96 units, costing 5.9d. or 11.8 cents.

All the hot water for baths, for the domestic "wash" and much for washing-up, is furnished by a "Therol" water heater placed in the bathroom. This takes 200 watts and is continuously in circuit day and night, so that during a year it absorbs 1,747 units, costing just over £7 or $35. This is by no means excessive when it is remembered that every day either some

30 gallons of hot water can be drawn out, or 9 gallons of boiling water or practically an unlimited amount of warm water. In practice this is sufficient for an average of 1 hot bath every day and for all the hot water needed in the house. Three hot baths can be obtained in succession, but this exhausts the heater and several hours must elapse before it can again deliver any large quantity of hot water.

As a matter of fact it was never found that the demand for hot water exceeded the capacity of the heater, and only on one or two occasions did the temperature of the water fall below that needed, and then only by reason of an abnormal drain on it previously.

The great advantage of this type of heater is that tepid, hot or boiling water can be drawn off in large quantities at any moment, day or night, simply by turning the tap. No switch has to be operated, and no attention is required. The heater has been running for 4 years and still works with its original heating element; trouble was at first experienced owing to the water coil inside becoming choked with lime due to the "hard" water supplied. This trouble was overcome by a change in design of the internal piping and has not since occurred.

For rapid tea-making a "Fuller" Geyser is employed. This is a neat device placed over the sink in the scullery, and giving sufficient boiling water for a pot of tea within 5 seconds of turning on the tap. It is wonderfully convenient to be able at a few seconds' notice to serve a cup of tea or coffee, freshly made with water actually boiling as it falls upon the tea leaves or coffee. Throughout the three years this geyser never failed once, in spite of the "hardness" of the water supplied, but could always be depended upon to furnish any desired quantity of hot or boiling water at the rate of half a gallon per minute.

Turning to the heating question, all the rooms have been warmed by electric radiators, convectors, or radio-convectors, and in spite of severe weather conditions, no trouble has been experienced in maintaining an agreeable and comfortable temperature. Even the hall, landings and stairs were warmed, the temperature never being permitted to fall below 50° F. during the day. The living rooms were kept at about 60° F. and the bed-

rooms at 55° F. The heaters employed include luminous radiators by the Dowsing Company, Electric & Ordnance Co., and Siemens. Convectors by the British Prometheus Co. and Electric & Ordnance Co., and radio-convectors by Ferranti & Bastian. Both the latter employ quartz glass, and both glow with a bright cheerful red. They are powerful heaters, and make effective substitutes for a coal fire.

Tests of the heating were taken during the coldest days, with strong easterly winds, no sun, and an outside temperature of 34° F.

The Electrical energy needed to maintain the inside temperature at an average of 61° was for room of 1,300 cubic feet, 750 watts; another of 2,750 cubic feet, 1,000 watts; a third of 2,500 cubic feet, 1,000 watts; and af ourth of 2,200 cubic feet, 900 watts. The saving in labour, dirt and dust, and the maintenance of a pure atmosphere, were worth all the extra cost over coal, which was then obtainable at 27/— per ton.

As regards cleaning, two electric vacuum cleaners, have been in constant use, a light portable type similar to the " Magic " (referred to under the heading of Electric Cleaning), and a cabinet type similar to others described there also. It is so simple to keep the house, furniture, curtains and upholstery free from dust by the aid of the electric suction cleaner, which any lady can use, and my friend's wife regarded " sweeping " and " dusting " as pastimes.

Among other accessories in daily use are toasters; chafing dish, coffee percolator; hot-water jugs; bed-warmers; cigar lighter, switches for turning down the lamps; electric lock for the front door operated from any room; telephones from room to room; electric clocks in every room controlled by a master pendulum in the hall; egg boilers; electric ventilating fans for summer use; hair dryer; goffering iron heater; kettle for the morning cup of tea upstairs; food warmer for baby's meals at night; electrically driven sewing machine; electric glue pot; electric soldering iron; portable electric lamps; electric cycle lamp, hot plates for keeping food and plates warm; transformer for ringing the house bells without a battery; hat pad for ironing silk hats; and a host of other useful novelties which make so great a difference to the conveniences and pleasures of life.

One servant can easily do the work in this ten-roomed house, and has an easy place. The decorations, paint-work and ceilings are as clean to-day as in 1909, and will need no attention for another year or so. The wall papers have not faded; the curtains do not rot; the carpets retain their pile and colouring longer; the picture frames do not become discoloured and the picture hooks and curtain hooks never turn green or corrode, as they do where gas is used, while plants thrive in the electric atmosphere.

An Electric home is a happy one because so many of the domestic cares are removed and more healthy conditions exist.

The heating, cooking and cleaning in the homes of the future *must*, therefore, follow the footsteps of Electric Lighting. Gas Companies will try and " belittle " the many advantages, others will say that the time is not ripe for it, and that their servants or housewives will not be able to understand its use. To all these I say *Test it.* Get your Electrical Supply Engineer to put in a small cooker and heater on trial, with a separate power circuit and meter, so that you can check the cost, and I do not fear the result. The gas and coal apparatus supplier will try and put upon the market more economical and hygienic appliances, but they will never keep out the dirt and dust or give such a healthy atmosphere as electricity. I know many houses and flats where the saving of decorations alone has paid the cost of the lighting bill, and in many cases the home would have been saved upset and expense for another year at least had it not been for the dirt on the walls caused by the use of coal and gas. In large blocks where the warming is done by steam from a central heater the steam radiators will be reduced to very small dimensions for use during the coldest weather to maintain a temperature of 50 and 55° F., the Electric heater being used in individual cases where higher temperature is required in any room. This will mean much healthier conditions in the flats and offices both in England and America, where the rooms are often raised to an unhealthy degree, causing colds, drowsiness, catarrh, and many other of the ailments of City life.

Other Examples of Electric Homes. An example among large English private houses equipped with electric cooking apparatus is that of Alderman J. P. Smith of Barrow-in-Furness,

which has been fitted with 5 single "Tricity" cookers, two extension cookers, and two large ovens with plate-warming hood above. There are also two other single cookers for use with water urns. A complete range of special utensils for use with the "Tricity" cookers has been installed, comprising kettles, steamers, ham and fish kettles, vegetable boilers and so forth. The average consumption per day for a household of 5 adults works out in this case at 8 units, so that the total cost for cooking amounts only to 4/8, or just over a dollar, per week, a very moderate figure for the amount of cooking carried out.

Another example of an all-electric home in England is that of Mr. H. Purle, 26, Gerard Road, Barnes, S.W. Mr. Purle has run his house on electrical lines for 3 years or more. Most of the apparatus is of the self-contained type consisting of oven, a large number of kettles, saucepans, stew-pans, frypans, toasters and the like; convectors for heating the various rooms; electric geysers over the sink in the scullery and the bathroom basin; a powerful heater for warming the bath and washing-up water; an electrically driven wringing machine; an electrically heated copper for washing clothes; electric fan for drying clothes; irons and many other useful appliances for domestic comfort. The cost works out less than that previously involved with gas and coal, with much greater convenience, cleanliness and simplicity. The annual cost of electricity for lighting, heating and cooking is about £12.10.0.

SOME TECHNICAL TERMS SIMPLY EXPLAINED

Ampere. This is the unit of current, and is named after Ampère, a famous French investigator in electrical science. Taking water as an analogy, there are two factors to be considered. There is pressure and there is quantity. Pressure is expressed electrically by volts; quantity on the other hand, is measured by amperes, its equivalent in moving water being gallons.

Broiler. See Grill.

Circuit means the path through which electrical energy waves or travels out and home again. No wave or flow of current can take place unless the conducting medium is continuous throughout. The conducting insulated wires form part of the circuit, which is completed by the filament inside a lamp, the heating element in a cooker, or the windings of a motor. Usually it is broken in 2 places, once at the switch and once at the fuse or cut-out (described elsewhere). These breaks in the circuit may be on one wire only, i.e., the wire leading to the apparatus, or both on this and on the return wire. If the switch is turned off, or the fuse removed or "blown," no current can possibly pass through the circuit, and the wires or any interior portion of the apparatus connected in that circuit may be handled with impunity. A circuit is completed when the *slightest contact,*—even only a pin's point—is made between the conductors, but heat will be generated if the surface contact, or the conducting material, is not adequate for the current flowing.

Circuits in Parallel. Lamps or other apparatus are said to be in parallel when they are connected across both the wires of the supply mains, each lamp being joined up independently, and receiving the full pressure of the circuit. The removal of one lamp from a fitting so connected does not affect the remainder, every lamp being independent of the others. This system of parallel

working is adopted almost exclusively in lighting practice, and most heating elements, radiator lamps and other devices are nowadays designed to work at the full pressure of the circuit, which may be anything up to 250 volts. The elements are thus self-controlled and operate independently, the failure of one not affecting the others. Such elements, as mentioned previously may, however, be joined up two or more in series, but this is only to allow for heat regulation, a convenient arrangement which is frequently adopted.

Circuits in Series. Lamps, elements or other resistances connected in series are arranged so that the current passes first through one, then to the second, and so on, the lamps forming, as it were, a chain. If one lamp be removed, the whole of those lamps, etc., connected in series go out, because one link in the chain is missing. When connected in series, each lamp or other device receives only a portion of the full pressure (voltage) of the supply mains, the amount being proportionate to the resistance of the individual lamps, etc. Thus if 4 lamps rated at 50 volts were connected in series on a 200-volt circuit, and the resistance of each was identical, they would all glow brightly, just as if they were connected separately to a 50-volt circuit. If, however, 4 lamps of similar candle-power, intended for single burning on a 200-volt circuit, were connected in series, each lamp would only receive 50 volts, and would consequently burn at a dull red. Cooking and heating elements, intended to take the full voltage of the supply mains, are often connected two in series, in order that they shall receive only half the pressure, and consequently give out only half the heat which they would produce at the full voltage. Series connection is thus used practically for heat regulation and is a convenient and efficient system. Under a hot plate two elements may be connected either singly or in series according to the heat required on the working surface, and when they are in series *each* gives *half* its *full* heat, but the heat is evenly distributed all over the surface of the plate, since the whole of the elements are running, though at a lower temperature. Three degrees of heat can be obtained in this way with 2 elements, which may be connected (1) singly across the full pressure of the

supply mains (half heat); (2) two in parallel across the full voltage (full heat); or (3) two in series ($\frac{1}{4}$ heat). These degrees of heat variation give everything which is required in practice.

Circuits of D.C. or Direct Current. There are two systems of electrical supply, by direct or continuous current, written *D.C.* for short, and by alternating current, written *A.C.* It is a matter of indifference to the consumer whether he be supplied with one or the other, since either will carry out all the work he requires with equal convenience, the same cost and identical results. It is not within the scope of this book to enter into the reasons for giving the two systems; they are based upon local conditions and depend principally upon considerations of economical transmission. Direct current is a wave or flow of electrical energy continuously in one direction so long as a circuit is closed. That is to say, briefly, the current enters the house by wire *A*, passes through the house wires, lights up the lamps or heats the cookers, etc., and returns to the generating station by the second wire *B*.

Circuits of A.C. or Alternating Current. On the other hand, alternating current is an intermittent supply, altering in direction many times every second. An impulse or current is first sent through wire *A* as before, through the house wires and back again, the whole operation taking perhaps one-fiftieth part of a second. For an instant there is no current passing. Then a current is sent in the opposite direction, entering through wire *B*, passing backwards through the house wiring, lamps, and cookers, and returning through wire *A*. Another brief pause ensues, and the operation is repeated. The rapidity of the alternations is so great that the lamps appear exactly as they do with a continuous current supply, the filaments glow steadily all the time. They have no time to cool after one impulse has ceased before they are heated again by an impulse in the opposite direction, and the same thing happens in the case of the heating elements on cookers. If the alternations were much slower it would be possible to see the lamp filament first glow brightly then become dull and again brighter, but in practice there is no perceptible variation in the light.

Cut-out. See Fuse.

Earthing. Reference has already been made to the advantage of "earthing" portable apparatus such as cookers. A connection to earth may be made by running a naked wire from the device needing it, to the nearest water pipe, or to the steel tubing laid throughout the house for the electric light and cooking supply, provided this tubing itself is electrically continuous, i.e., that every length is connected firmly by screwing or otherwise to its neighbours. If the wiring has been carried out in what is known as "slip-joint" conduit, this is not the case, and the conduit is useless for providing an "earth" connection, but the wiring installed for cooking circuits is usually enclosed in screwed tubing, which provides an excellent means for earthing, since it is in direct metallic contact at all points with the armouring around the Supply Company's mains in the ground, or has been connected by the wiremen to a convenient water pipe. When apparatus has been properly "earthed," it cannot become "alive" or charged with electricity, and cannot transmit a shock to the user in any circumstances. If a leakage of current should take place owing to a fault somewhere in the cooker or its connections, the earthing wire carries the current which may thus pass, harmlessly away to the earth. If the leakage is of any magnitude it may even cause one or both of the cut-outs on that particular circuit to "blow," but this is the worst that can happen, and no danger can possibly exist where the cooker is properly earthed. In practice the contractor putting the cooker in position would naturally earth it at the time, but it is well to ascertain that this precaution has not been neglected.

Electromotive Force. See Volts.

Electrical Energy. See Watts.

Element. See Heating Elements.

Flexible. This is the term given to the silk, cotton or metal-covered flexible conductors which connect the supply wires to portable apparatus. It has usually two conductors formed of many fine copper threads braided together to give flexibility, and its size varies according to the amount of current it is intended to carry. Thus for a single pendant lamp or portable table light, it is quite small and covered outside the insulating rubber with fancy-coloured cotton or silk. For use with cookers or apparatus

taking heavier currents, it is stouter and better protected from mechanical injury, the larger sizes often being armoured with braided rubber, braided copper or steel, or with flexible metallic tubing such as is used to convey gas to a ring or fire. When a metallic armouring is employed, this covering is connected both to the frame of the cooker and to the steel tubes in which the permanent wires are laid. If a metallic armouring is not used, the flexible wire usually has a third conductor which is used for the purpose of " earthing " the cooker as it is called, i.e., connecting its frame to " earth " through the steel conduit laid carried in the house, which in turn is connected to the lead armouring surrounding the supply company's mains buried in the ground outside. For use with armoured twin flexibles or three-conductor unarmoured wires, special 3-pin plugs are provided, which fit into sockets on the wall or control panel, the third or " earthing " pin being made larger in diameter than the two used for carrying the current in order that the user may not reverse the position of the pins when inserting the plug.

Fuse or Cut-out. This is a form of safety-valve inserted at a convenient point or at several points in a circuit. The connections are usually mounted on china, with a detachable china lid or cover. Between the terminal pieces connecting the circuit wires there is a thin strip of tin, lead or other alloy. If, from any cause, more current passes through the circuit than it is intended to carry, this piece of metal, being of smaller sectional area than the remaining portions of the circuit and melting at a comparatively low temperature, becomes unable to carry the additional load without overheating, and the piece consequently " blows," fuses or melts, thus breaking the circuit and stopping altogether the flow of current through it. If no fuse were there to protect the circuit, and an excessive current were permitted continuously to pass through it, the conducting wires themselves might become heated and ultimately set fire to the insulating material surrounding them. Anyone after a little instruction can insert a new fuse, if one should for any reason " blow " (melt or give out). The main or controlling switch must be *off* while it is being done. But if when this is done, the fuse again blows, it is evidence that a fault exists somewhere in the circuit, and it is best to send for

an electrician to locate and remedy it. The first screwed cut-outs or fuses were introduced by the Edison Co., in 1881. The first bar cut-outs were introduced by Grivolas Fils in Paris and by Fowler and Lancaster in Great Britain in 1887. Fuses may be arranged singly or in groups, where there are several adjacent circuits, a common plan being to fit a number in a fuse or distribution board, with glass door and detachable porcelain fuse-carriers. This is usually done in the case of lighting circuits and sometimes for cookers and heaters as well, but the more usual method in the latter case is to mount the fuses on the panel fixed to the wall behind the cooker. These fuses are generally circular in shape with china covers and bases, the fusible portion being in the form of a tube, ring or disc, which when blown can be replaced by a new one. This type of fuse has many advantages. It indicates in a simple manner when it "blows," so that the user can see at a glance which fuse needs attention; it occupies little space and it is impossible to insert a fuse of larger section and therefore of greater current-carrying capacity than was originally intended. In other words, the limit of safety cannot be lessened without removing the cut-out altogether and fixing a larger one. Such a fuse is usually provided to control every individual circuit in a cooker. Thus there is one for each boiling disc, one for the grill, another for the hot cupboard, and one or more again for the oven.

Grill or Broiler. The electric Grill usually has wire elements which run at a bright red heat, since radiant heat is necessary for grilling work, and the brighter an element runs, the larger is the proportion of radiant heat emitted from it. The element is not as a rule enclosed, but is exposed, protection from mechanical and electrical injury being afforded by a wire or perforated guard or similar device. No heat regulation is needed for a grill, as it is either wanted full on or not at all.

Heating Element. This is the part of the Cooking and Heating apparatus in which the electrical energy is converted into heat. Detailed and full description is given under the Section dealing with Heating Elements.

Hot Cupboard. Is a useful apparatus or attachment to an oven or cooker for keeping plates and food warm, and uses but

little current. Indeed it frequently happens that when attached to an oven or cooker no heating element is employed for the hot cupboard, the heat escaping from the oven, grill and boiling discs being sufficient to keep it hot.

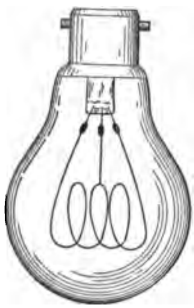
Hot Plate. Hot plates is the term usually given to the appliances for heating liquids. They are placed usually on the upper part of a cooker, and are mostly circular in form, with a heating element attached to the under side of the working surface and insulated from it by mica, asbestos or other material. They may be rated to take any current necessary to give heats up to a dull red, and are made in several sizes from 6″ to 12″ in diameter. They are used to heat flat-bottomed utensils for boiling, frying, simmering, and so forth, and their working surface is ground absolutely flat. It is most important that utensils used on hot plates should have their bases perfectly flat so as to maintain contact all over with the heating surface, otherwise a serious loss of efficiency may result. Some makers supply utensils of cast aluminium, which are practically everlasting and always keep flat underneath, the bottom having been ground true. Hot plates are used in a similar manner to gas rings, but give off no injurious fumes, and when forming part of a cooker top, the vessels may be placed over them or moved to one side, according to the degree of heat required. For example, three vessels may be heated over one hot plate by standing partly over the disc and partly over the top plate of the cooker, each receiving a proportionate and equal degree of heat. This is useful for slow cooking, simmering and casserole work. Heat regulation is provided, however, for use when one vessel at a time is being heated, and the usual practice is to give 3 changes, "high," "medium" and "low." These are secured by switches mounted on the control panel or on the cooker itself.

Kelvin. See Unit.

Kilowatt, kw. See Watt.

Kilowatt-hour, kw.-hr. See Unit.

Pilot Lamp. This is an incandescent electric lamp, usually with ruby glass, placed in circuit with the cooking elements in order to give ocular evidence that the cooker is taking current of high or low heat. Its use minimises waste through careless-

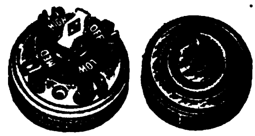


Pilot Lamp.

ness or forgetfulness, and it is usually mounted alongside the heat-control switches and the cut-outs on the panel at the back of the cooker. A flag indicator may be used instead of a lamp.

Resistance. Resistance to the flow of current is set up by impeding its passage. In the case of liquids, a small pipe sets up resistance to the flow of water, and an electrical conductor sets up resistance to the flow of current if it be of small diameter or of great length, or if it is composed of a metal which is not suitable for carrying current. Resistance to the flow of current is to be avoided at every point in the supply system and circuits, except at those points where heat is required, for it involves waste of energy, and may lead to trouble through local heating. In order to avoid causing resistance, the conducting wires must be of ample size to carry more than the current for which they are intended and must be made of a metal which has a high factor of conductivity. For this reason copper is usually employed. At the point where heat is required, a resistance is deliberately inserted in the circuit, and this resistance is placed in ovens, in toasters, beneath hot plates or in convectors for warming rooms. The filament of a lamp has a very high resistance, being made of an extremely fine wire of considerable length, formed of a metal which is of great hardness and low conductivity. It is enclosed in a glass bulb from which all air has been extracted, and is thus able to operate at an incandescent heat without burning out. If the glass bulb were pierced so as to admit air, the filament would burn out immediately. Heating elements for convectors and cooking apparatus are not enclosed in a vacuum and therefore cannot run for long at an incandescent heat. Their resistance is lower than that of a metal lamp filament, and they are much stronger mechanically, being of larger size. Bad contact sets up resistance and is to be avoided, therefore it is important to see that switches make good contact at the terminals and that all wires are screwed tightly home wherever they are joined

up or connected to the terminals of the apparatus.



"Diamond H." Series-parallel Switch for Use with Cookers.

Short Circuit. This is a fault which may occur in any circuit through accidental contact between the outward and return—called the positive and negative—wires. It may arise through a broken wire, through faulty insulation, through excessive moisture, through the wires being touched by a foreign piece of metal, or in the case of a lamp, by the undue shortening of the filament through vibration. It gives rise to a rush of current through the circuit, due to the easier or shorter path available to the current, and as explained above, the excessive current passing through the protecting fuse, heats and melts the thin wire provided for the purpose, thus breaking the circuit, preventing any further passage of current, and obviating all risk and trouble.

Switch. This is the device used to shut off or to admit current to a circuit. It is equivalent in some degree to a water tap (which either stops, or permits of, the flow of water). It may merely break or close a single circuit, or it may be so designed that it will complete one circuit and break another, or again it may complete or break two or more separate circuits. This is simply a matter of design, a switch combining several movements being smaller and less costly, as well as more simple, than a number of single-acting switches. The switch may have a rotary movement, actuated by a revolving button, with contact connections for several circuits such as is employed on many types of cookers to control the varying degrees of heat, as in the Diamond H switch; it may have an upward and downward movement worked by a rounded knob, as with the familiar tumbler action, used widely in England for lighting work; or it may be actuated by a straight lever which forces knife blades into contact with spring clips connected to the circuit wires. In whatever form it may be applied, the effect is the same in all, and in every pattern the handle touched by the handis insulated from the parts carrying the current. The contact made by the switch must be firm and rapid in making and breaking.

Tumbler Switch.

Tumbler Switch by the Edison & Swan Co.

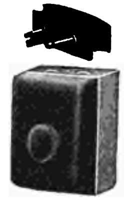
Unit or Kelvin. A (B.O.T.) Board of Trade unit is 1000 watt-hours, also expressed as kilowatt-hour, kw.-hr. Thus a lamp rated at 50 watts will run for 20 hours before it consumes 1000 watt-hours. A 25-watt lamp will only use the same amount of power in 40 hours, irrespective of the voltage of the supply, since the watts, as stated above, are a multiple of the ampere and volt. Putting it another way, a 50-watt lamp running on a 100-volt supply, will take $\frac{1}{2}$ ampere, and a 25-watt lamp $\frac{1}{4}$ ampere. On a 200-volt supply, a 50-watt lamp takes $\frac{1}{4}$ ampere, and the 25-watt lamp $\frac{1}{8}$ ampere. A 50-watt lamp costs exactly the same to run on a 200-volt supply as on a 100-volt circuit, and gives exactly the same light, provided it is run at the correct voltage marked on its cap. Recently the unit has been rechristened the *kelvin*, in honor of the late Lord Kelvin, but the original term will not easily be displaced.

Volts. A volt is the unit of electromotive force, or in simple language the pressure at which the electric current is supplied. It is so named after Volta, the celebrated Italian physicist. In order that the current may pass along the conducting wires to supply the lamp, cooker or other apparatus, it must be forced under pressure, exactly as water requires a head of so many feet to give the necessary impulse to send it through the pipe system. If a large pipe is used, less pressure is needed on account of the smaller surface friction encountered, and in the case of electricity a wire of larger diameter must be employed if the pressure or voltage is low than if a higher pressure is impressed. Nowadays the pressure most usually adopted is 200 to 250 volts, a low-pressure supply being at 100 to 110 volts. Since the employment

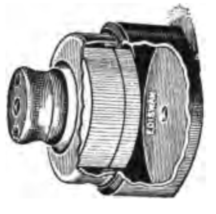
of a high pressure makes possible the use of smaller wires (which, taking less copper and less rubber insulation, are materially cheaper than large ones), it is more economical both to consumers and to supply undertakings to make use of high pressures. In practice, the pressure at the consumer's terminals is not that at which the current is generated, a far higher pressure being used, sometimes thousands of volts, to convey the power from the generating station through the streets. In this way, a great deal of energy can be conveyed cheaply for long distances through wires of small size. Before entering the premises of users, this pressure is reduced to the figure above mentioned, by means of transformers or converters, placed under the street or in small sub-stations at convenient centres for distribution. The B.O.T. limits the maximum pressure for domestic use, to 260 volts, but in certain cases for cooking and heating circuits, it allows of pressures double this value, provided adequate precautions are taken to eliminate risk.

Watt. This term is used to express the rate at which electrical energy is being used. The term is named after James Watt, the celebrated engineer who introduced steam power for commercial use. Being dependent not only upon the quantity of current (in amperes), but upon the pressure at which that current is forced (in volts), its value is found by multiplying the known volts by the known amperes. Thus if the supply pressure be 200 volts, and 5 amperes of current are being absorbed in the circuit using electrical power, the watts are expressed by $200 \times 5 = 1{,}000$. Lamps, cookers, heaters and other appliances are usually rated in watts, i.e., a 500-watt kettle takes 5 amperes at 100 volts, or 2.5 amps. at 200 volts, and so on. It is thus simple to calculate from any maker's list (in which the articles are usually rated in watts), the current (amperes) which they take, provided that the supply pressure (volts) of the supply upon which the device is to be used, is known at the time. 1,000 watts equals 1 kilowatt, usually expressed as kw.

Watt-hours. Watts being the rate at which energy is flowing through a conductor at any moment, the watt-hour introduces the factor of time, so that the total power consumption for any given work over any required period of time may be calculated,



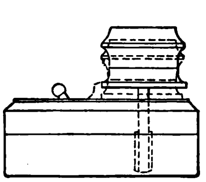
" Ediswan " Combined Switch and Wall Socket.

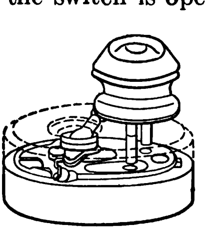


" Ediswan " Wall Socket.

the hour being taken as the standard. If a certain operation takes 1,000 watt-hours, it will imply that, if the supply pressure is at 100 volts, 10 amperes were taken for 1 hour, 1 ampere for 10 hours, or 5 amperes for 2 hours or the equivalent.

Wall Socket. This is a device with two or three recesses terminals mounted on a china base, usually circular in shape. The two supply wires are taken through a switch and fuse to the terminals from behind, and the third terminal, if there be one is connected to " earth." The flexible wire is attached to a 2- or 3-pin plug which fits into the socket, two of the pins being used to carry the current and the third acting as an " earthing " terminal. A special form of earthed iron-clad plug and socket has been devised by Reyrolle & Co., Hebburn-on-Tyne. In order to guard against the flexible wire being left " alive " when the apparatus to which it is connected is not being used, and to ensure that the terminals of the wall socket shall be dead when the plug-top has been removed, several forms of interlocked switch-plugs have been introduced. The accompanying diagrams show the action of the pattern made by the B.T.-H. Co. of Rugby, with which it is impossible to withdraw the plug without opening the switch, or to insert the plug unless the switch is open.





Interlocked Switch-plug by the British Thomson-Houston Co.

PRICES CHARGED IN GREAT BRITAIN AND THE UNITED STATES FOR HEATING, COOKING AND POWER SUPPLY

The following list does not purport to include all the cooking and heating tariffs in force, but it sets out the more interesting ones, together with a goodly allowance of ordinary typical cases.

It must be borne in mind that many of the names omitted correspond to towns in which no special attention has yet been paid to Heating and Cooking, and where, therefore, it is merely treated as the ordinary demand.

Where a primary fixed charge is made based either upon the kw. capacity of the apparatus installed or upon the rateable value of the premises supplied plus a rate of so much per unit for all current used, the system of charging covers all uses.

In places where the "maximum demand" (M.D.) system is adopted, consumers are charged for current at two rates per unit, one comparatively high and the other quite small. The higher rate applies until energy has been used equivalent to the maximum consumption agreed upon for one hour, or a given number of hours per day, all current in excess being supplied on the lower basis.

In districts where the "telephone" system is available, consumers pay in advance a fixed annual sum for the electrical service, plus so much—usually 1d. per unit—for the current used. The plan is analogous to a telephone subscription on the message rate system, whereby an annual sum has to be prepaid to cover the capital charges of the service, plus 1d. per call. Where a time switch is employed, the supply is automatically cut off during those times when the demand for current for lighting purposes is greatest, but is available at all other hours at a specially low rate.

PRICES CHARGED FOR HEATING, COOKING AND POWER SUPPLY IN GREAT BRITAIN

Name of Town.	Charge per Unit or Kelvin for Heating and Cooking.
Aberdare	1d.
Aberdeen	1d. for first 500 Kelvin or units per half-year. ¾d. all over 500 do.
Accrington	12½% on rateable value+½d. Charge includes lighting, as in all similar cases.
Altrincham	1½d.
Ayr	1d. and a meter rent.
Banbury	1¾d.+meter rent.
Barking	1½d.
Barnes	10 per cent. rateable value+1d. in winter quarters and ½d. in summer quarters.
Bath	1¾d., less sliding scale of discounts.
Battersea	1d. flat rate or £4 per kw. on the maximum demand per ann. plus ½d.
Beckenham	By Therol Heater or other apparatus which ensures a constant load, 1¼d. per unit. For separate heating and power circuit where lighting circuit is installed either (*a*) 4d. per unit during 2 hours of peak load during October to March inclusive, and 1d. for remainder of the 24 hours and during whole 24 hours from April 1st to September 30th, and no charge for meter or time switch, or (*b*) 2d. per unit for supply at any time plus rent for meter.
Bedford	1d. net.
Belfast	2¼d. for first 182 hours per half-year of maximum demand and 1d. after.
Birkdale	2d.
Birkenhead	1½d. for first 1500 units per quarter and 1d. after.
Birmingham	1d.
Bishop Auckland (Cleveland and Durham)	1½d.
Blackpool	12½% on rateable value + ½d.
Bolton	For heating, and similar apparatus, with a demand of 1 kw. and over, the price is at the rate of 2d. for the first 1000 units per quarter and 1d. for all used over this amount, both prices being subject to a discount of 10 per cent. if the account be paid within twenty-one days. For apparatus with a demand under 1 kw., the price will be the same as charged to consumers for lighting (i.e., 3½d.).

Name of Town.	Charge per Unit or Kelvin for Heating and Cooking.
Bournemouth and Pool....	1½d. with large discounts, which are based on quarterly readings so as to encourage use in summer months.
Bradford................	15 per cent on rateable value + ½d. for all domestic purposes, or sliding scale, 1d., 2d., or ¾d. (provided no demand during restricted hours) (time switch for this).
Bray....................	2½d. (gas 4s. 6d.), proposing reduction to 1½d.
Bridgend................	1½d.
Bridlington.............	2d. up to 200 ks. per quarter, and 1d. above.
Brighton................	1d.
Bristol.................	1d.
Bromley (Kent)..........	Flat rate 1½d. per kelvin or 12½% on rateable value + 1½d. for all current used.
Burton-on-Trent.........	1d.
Bury....................	1d.
Buxton..................	1½d. to 2½d. (less 10 per cent. cash discount).
Cambridge...............	1½d.
Canterbury..............	1½d. (less cash discount).
Cardiff.................	1d. (hope to reduce to ½d.).
Carlisle................	One-eighth of net rateable value per annum + ½d. per kelvin for all purposes, if house electrically lighted.
Caterham................	2½d., or special arrangements.
Chelmsford..............	3d.
Cheltenham..............	1d.
Chester.................	1½d. first 200 units per quarter, 1d. after.
Chichester..............	1¾d.
Chiswick................	2d.
Cleckheaton.............	2d. and 1d. maximum demand system, less discounts.
Cleveland and Durham...	1½d.
Colchester..............	2d.
Colwyn Bay..............	3d.
Cork....................	For heating, a sliding scale 1½d. up to 150 units per quarter, 1¼d. up to 400, 1d. above 400. For cooking, 1d.
County of London E.S. Co.	1½d.
Coventry................	1d.
Crewe...................	1d. to 2d.
Croydon.................	1d. if electric light used, otherwise 1½d.
Dalkeith................	1½d.
Darlington..............	1½d. to ¾d. (sliding scale).
Dartford U.D.C..........	Are at present revising tariff so that heating and cooking will come on the 1d. scale.
Dawlish.................	3d.
Derby...................	1d.

Name of Town.	Charge per Unit or Kelvin for Heating and Cooking.
Dewsbury	Two systems to choose from:—Maximum demand system of 2½d. for one hour per day and ½d. after; or time switch system at ¾d., plus a rent for switch.
Dollen	1½d.
Dover	2d. for first 100 units each quarter and 1d. after (average works out 1.20d. 1—1.13d.).
Dumbarton	1½d.
Dundee	1⅛d. for the first 100 kelvins per quarter. ⅞d. all above first 100 kelvins per quarter. The department has a tariff whereby a consumer who guarantees the department his previous average bill for lighting that he has previously paid, anything that he might use for heating or cooking or for domestic motors, etc., can be got at heating rates, although the consumption is registered only through one meter.
Ealing	1d.
Eastbourne	Less than 10,000 kelvins, 1½d.; 10,000 kelvins and over, 1.15d.
East Ham	From 2d. to 1d. on a sliding scale.
Elland	2d.
Erith	1½d.
Exeter	2d. (1st 100 kelvins per half year), 1½d. per kelvin for next 400, 1d. per kelvin for all in excess of 500 per half year.
Exmouth	1½d.
Falkirk	2d.
Falmouth	1½d.
Farnworth	1d. if electric lighting, 2d. otherwise.
Finchley	2d. for first 90 hours maximum demand per quarter, 1d. all after.
Fleetwood	1½d. by separate meter or system of charge involving power prices in daytime and lighting prices at night.
Gillingham	1d. for first 300 kelvins per quarter, and ¾d. after.
Glasgow	A tariff specially devised for ensuring a supply for heating and cooking at practically 1d. No second meter.
Glossop	1½d.
Gloucester	12½% on rateable value, plus 1d. per kelvin. This includes charge for lighting.
Gravesend	Tariffs for heating and cooking are all round ratc 1½d. but if load such that it is not likely to be used during lighting peak 1d. is charged.
Greenock	£6 to £9 per kilowatt installed per annum + ¾d. per kelvin.

Name of Town.	Charge per Unit or Kelvin for Heating and Cooking.
Grimsby	1d. (less cash discount).
Hackney	1d.
Halifax	2d., less 5 per cent.
Hitchin	1½d.
Hampstead	Telephone system with secondary charge of 1d., or 1½d. flat rate.
Harrogate	2/6 per quarter per kw. instilled+¾d. per unit, less 5% disct. if electric light is used.
Harrow	1½d. in winter, 1d. in summer, or 8d. in £ per quarter on rateable value, plus 1¼d. in winter and 1d. in summer. This includes charge for lighting.
Hastings	1½d.
Hawick	Cooking 1d.; heating 10s. per annum+1d.
Heston and Isleworth	Telephone system with secondary charge of 1d.
Heckmondwike	1d.
Hendon	1½d.
Hereford	With telephone system, 1¼d., less 5 per cent. cash discount, or alternatively double tariff system or flat rate 4½d.
Hornsey	£3 to £3 15s. per annum+¾d., or 2d. flat rate, or m. d. 2½d. for first 100 hours per quarter and 1d. after.
Horsham	1½.
Hove	Maximum demand 3d. first hour per diem, 1d. after.
Huddersfield	2d. for first 200 hours per half-year and 1d. beyond (discounts for big consumers).
Ilford	12½% on rateable value+½d. per unit.
Ilkeston	1¼d.
Ingleton	1d.
Inverness	1d.
Ipswich	1d.
Isle of Thanet	1½d.
Islington	1d.
Jedburgh	1½d.
Keighley	1¼d.
Kendal	2½d. for first 1000 kelvins per annum, 2d. for second, 1½d. after.
Kensington and Knightsbridge	1½d. flat for heating and cooking, with alternative to go on the power rate (which varies from 1d. upwards).
Kettering	1d.
Kilmarnock	1¼d.

Name of Town.	Charge per Unit or Kelvin for Heating and Cooking.
King's Lynn	1½d., 6d. per quarter meter rent for the second meter.
Kirkcaldy	First 500 units per annum 2¼d., and next 500 units 1¾d., and sliding scale to ⅞d. for large consumers.
Lancaster	£1 2s. 6d. per quarter per kilowatt installed +.33d. and 5 per cent. discount for cash.
Leatherhead	2d. first 100 units, 1½d. after. In summer 1d. throughout.
Leeds	1d., less 5 per cent.
Leek	1.35d. to 2d.
Leicester	1d.
Lewes and District	2¾d., flat rate, or 5d. and 1¾d. maximum demand.
Liverpool and District	1½d.
Llandilo	3d.
Londonderry	1d.
Loughborough	1d.
Lowestoft	1d.
Luton	½d.
Lymington	Flat rate 2½d., or maximum demand 4d. and 1½d. or yearly contract 10s. per kw.+2d. per unit.
Maidstone	1d.
Malvern	3d.
Manchester	12% on rateable value plus ½d. per unit subject to a minimum kw. of apparatus being installed.
Mansfield	1d.
Melrose	1½d.
Merthyr	1d.
Metropolitan Electric Supply Co.	Where lighting is already in use and where there is only one circuit and one meter, a fixed charge per ann., and in addition 2d. for all units whether used for lighting or cooking and heating, up to the amount of the fixed charge; all units in excess are charged at 1d. For energy used for heating and cooking only (supplied through a separate meter), a fixed charge of £1 per kw. installed per annum, payable in installments of 10s. during the two winter quarters, plus 1d. for all consumed.
Middlesbrough	1d.
Midland Electric	1½d., but ½d. per unit deducted if paid within 21 days.
Morley	1d.
Motherwell	A special tariff is being considered presently, that houses, etc., receive electricity at 1d. after a fixed average for lighting has been reached.

Name of Town.	Charge per Unit or Kelvin for Heating and Cooking.
Mountain Ash	2d.
Newcastle and District	Either 1½d. flat rate or else 12½ per cent. on net rateable value and ¾d.
Newcastle-under-Lyme	First 2500 kelvins 2½ per kelvin, second 2500 at at 2d., third 2500 at 1¾d., fourth 2500 at 1½d. Five per cent. discount to all using over 10,000 kelvins annually.
Newmarket	2d.
Newport (Mon.)	1d., 5 per cent discount if paid within the month.
Northampton	12½% on rateable value and 1¼d. If non-domestic, 1¼d. with separate meter.
Northwich	1½d.
Norwich	12 per cent. of rateable value plus 1d., all cooking thus at 1d. (With cooking, probably higher assesment charge +¾d. in future.)
Nuneaton	1d.
Oban	£1 per annum per kilowatt installed+1d.
Oldham	(1) maximum demand 2d. and 1½d.; (2) or else a system whereby first 500 units sell at 2d. per quarter, second 500 at 1¾d., and all in excess at 1½d.; (3) or else, two rate meters and 4d. on peak, lower charges of 1½d., 1¼d., and 1d. at other hours; (4) or else, combinations of methods Nos. 1 and 3.
Oxford	1½d.
Penarth	1½d.
Peterborough	1¼d. to 1½d.
Plymouth	1¾d. for first 100 per quarter, 1½d. after.
Pontypridd	1½d. and 1d.
Poplar	8s. per kilowatt installed plus 12½ per cent. per annum on cost of apparatus and expenditure in connection with installation, plus ½d. used.
Portsmouth	First 25,000 kelvins per annum 1½d.; second 25,000 1d.; all after ¾d.
Radcliffe	1d.
Ramsgate	Maximum demand 4d. and 1½d., or else 2d. flat rate.
Rathmines	1½d.
Rawtenstall	1½d. to 1d. on a sliding scale.
Reading	½d., if lighting used also.
Rhyl	1½ (n.b.—alternatively for lighting, cooking, and heating on same meter 15 per cent. rateable value and 1½d.)
Richmond	1½d.
Salford	£1 per quarter per electric h.p. demanded, plus ⅓d. kelvin or flat rate 1½d. for first 1000 per quarter and 1d. afterwards.

Name of Town.	Charge per Unit or Kelvin for Heating and Cooking.
Salisbury	2½d.
Scarborough	1d.
Scottish Central (Falkirk)	1d.
Sheerness	2d.
Sheffield	10½% on rateable value, plus ½d. Charge includes lighting.
Shoreditch	1d. flat rate to consumers using electricity for power or lighting.
Shrewsbury	3d. up to 300 units a quarter, from 300 to 600 2d., all over 600 1½d. Discounts of 5 and 10 per cent.
Southampton	½d.
Southend-on-Sea	1½d. also several alternative rates.
South London	12½ per cent. on the net assessment per annum and ¾d. for all energy consumed.
South Metropolitan Electric Light and Power Co.	1½d.
South Shields	1d. per kelvin.
South Wales (Cardiff)	1½d.
St. Andrews	1½d.
St. Annes	First 200 units per quarter 2d. All in excess 1½d. 5% discount.
St. Helens	1d. for heating and cooking. The Council are at present considering a rateable value scheme for private house supply with a fixed charge based on 10 per cent. to 15 per cent. on the rateable value of the house, and ¾d.
St. Marylebone	The contract tariff consists of an annual charge payable yearly or quarterly in advance and ½d. for all units consumed. The annual charge is based on the wattage of the lighting installation.
St. Pancras	1d.
Stamford	2d., but special rebates for large demands.
Stepney	1d., but lower charges for big consumers.
Stockton-on-Tees	1d.
Stoke Newington	(1) For a maximum demand in any quarter not exceeding 17.5 kilowatts 4½d. for the first hour's daily use of the maximum demand, as shown by the demand indicator, and 1d. per unit for all further consumption. (2) For a maximum demand in any quarter exceeding 17.5 kilowatts, 3½d. for the first hour's daily use of the maximum demand, as shown by the demand indicator, and a 1d. for all further consumption.
Stoke-on-Trent	1d.
Sunderland	½d., if lighting load; ¾d. flat rate, through special meter.

Name of Town.	Charge per Unit or Kelvin for Heating and Cooking.
Sutton Coldfield	12½ per cent. rateable value+1¼d. winter quarters and ¾d. summer quarters.
Swansea	2d. for first hour of maximum demand per diem and 1d. after.
Swinton	1½d. for first 1000 per quarter, 1d. after.
Taunton	2d. for first 50 in any quarter. 1d. all additional.
Torquay	1d. (with special terms for large consumers).
Totnes	1½d.
Tunbridge Wells	1d.
Twickenham and Teddington	£1 per kw.+1d., or else flat rate 2d.
Tynemouth	1½d. for heating and 1d. for cooking.
Uxbridge	2½d.
Wadebridge	4d., less 5 per cent.
Wakefield	½d. + fixed charge.
Wallasey	1½d., less 5–20 per cent. discount for two–six hours' use per diem.
Walthamstow	For first 500 units a quarter 1½d., for next 500 1¼d., for all over 1d.
West Bromwich	1d.
Westcliff-on-Sea	See Southend-on-Sea.
West Ham	Fixed annual charge of 1/8 per 100 watts installed, payable in advance, minimum payment 10/— plus ½ per kelvin.
West Hartlepool	Existing lighting consumers may have current for heating and cooking at ½d. per kelvin, plus meter rent 6d. per quarter.
Westminster E.S.C.	1d.
Weston-super-Mare	1d.
Weymouth	2d. for first 120 per quarter, and 1d. for all above 120 per quarter.
Whitby	1d., plus a standing charge on appliance.
Whitehaven	1d.
Wimbledon	Under 220 watts installed lighting rates; above 220 watts, 1d.
Winchester	1½d.
Windermere	3½d.
Windsor	3d.
Witwood	2d.
Woking	2d. net.
Wolverhampton	½d. plus fixed charge.
Woolwich	.8d. to 1.0d.
Worcester	15% on rateable value + ½d.
Worksop	1d.
Worthing	1½d.
Wrexham	Fixed charge of 12½ per cent. on net assessment plus ½d.

Name of Town.	Charge per Unit or Kelvin for Heating and Cooking.
Wycombe	£1 per kilowatt installed + 1d. per unit.
York	Electricity may be obtained for domestic purposes where the premises are lighted throughout by electricity at a fixed rental of 10 per cent. of the net rateable value of the premises, plus 1d. per Board of Trade unit. The fixed rental to be divided between the two summer and winter quarters in the proportion of one-sixth for each summer quarter and one-third for each winter quarter. Where a consumer also uses electricity for heating or cooking purposes the charge will be 1d. for all electricity up to an amount equal to 75 per cent. of the fixed rental per quarter, and all further consumption in each quarter is ½d.; periods of less than one quarter to be paid *pro rata*.

PRICES CHARGED IN THE UNITED STATES, FOR HEATING, COOKING AND POWER SUPPLY

State.	Town.	Charge per Unit for Heating and Cooking.
Alabama	Birmingham	20¢ h. 25% discount.
	Demopolis	7¢ h. 25% discount.
	Huntsville	4¢ net.
	Mobile	3¢ net. Min. $1 per month.
Arizona	Douglas	20¢ Min. $1 per month. 10% if paid before 15th of month.
	Prescott	6⅔¢ h.
Arkansas	Little Rock	3.5¢. Min. $2.
	Hot Springs	12¢ for the first 200 kw.h. 5% discount if paid before 10th of month.
	Mammoth Spring	10¢ down to 4¢, according to quantity used.
	Rector	12¢.
	Texarkana	8½¢ for first 300 kw.h. down to .0465¢ for 1000 kw.h. with dis. 5% to 30%.
California	Alameda Co	3¢ net rate.
	Eureka	7½¢ for 600 to 799 kw.h.; 7¢ per kw.h. for 800 to 999 kw.h.
	Fresno	5¢ for first 30 hrs. use, max. demand, or fraction; 3¢ per kw.h. next 150 hrs. use of max. demand or fraction, and 1¼¢ for all excess. Monthly minimum, $2.
	Los Angeles	6½¢ for first 100 kw.h. Alternating Current 10% additional.
	Redding, Chico, Willows	3¢ for first 100 kw.h., down to 1½¢ for 300 kw.h. Min. Monthly bill, $1 per meter.
	Richmond	8¢ for first 30 kw.h. down to 5% for all over 200 kw.h.
	San Diego	4¢ net. Min. $4 per month.
	San Francisco	8¢ for first 30 kw.h. consumed in any one mo.; 7¢ per kw.h. next 70 kw.h.; 6¢ next 100 kw.h.; and 5¢ all over.
	Monterey	5¢ up to 250 kw.h. monthly, down to 2¢ for 6000 up to 10,000. Min. charge, $1 per h.p. per mo. for

State.	Town.	Charge per Unit for Heating and Cooking.
California .... (*Continued*)	Monterey........	5 h.p.; 75¢ per h.p. per mo. 5 to 25 h.p.; 50¢ per h.p. per mo. 25 h.p. and over.
	Sonora..........	6¢ per 1000 watts, between the hours of 6 a.m. and 5.30 p.m. Min. bill, $5 per mo.
	Stockton.........	7¢ min. monthly bill in Stockton. 8¢ min. monthly bill outside Stockton
Colorado......	Aspen...........	3⅓¢.
	Boulder.........	3½¢ net.
	Colorado Springs.	11¢ less 54%.
	Durango.........	5¢.
	Greeley..........	5¢.
	Leadville........	6¢.
	Mancos.........	16¢.
	Montrose........	6¢ first 30 kw.h.; 5¢ second 30 kw.h.; 4¢ per kw.h. third 30 kw.h.; 3¢ all over, with 10% dis. in ten days.
	Ouray..........	3¢ to 5¢.
	Palisade.........	12½¢.
	Salida...........	6¢.
	Steamboat Springs	15¢ with sliding scale of dis. from 5% to 33⅓%. 50 kw.h. is required to secure 33%.
	Sterling.........	12¢ net for first 50 kw.h.; 11¢ per kw.h. next 50 kw.h.; 10¢ net for next 100 kw.h., over 200 kw.h., special. $1.50 monthly min. plus rate from 4¢ to 8¢ depending on installation.
Connecticut...	Bristol..........	5½¢ to 2.7¢ per kw.h. from 250 to 4000 kw.h.
	East Hampton...	3¢. Min. $1 per month.
	Litchfield........	4¢. Min. charge $2 per month.
	New London.....	13¢ for first 100 kw.h. per mo.; 11¢ per kw.h. for all excess, disc. 1¢ per kw.h. payment in 10 days. Min. bill $1 per month.
	Staffordville......	4¢.
	Simsbury........	8¢. Min. charge $1 per month.
	Unionville.......	5¢ to 4¢.
	Willimantic......	4¢.

State.	Town.	Charge per Unit for Heating and Cooking.
Delaware	Wilmington	5¢. Min. monthly bill $1, 5% cash discount.
Dis. Columb.	Washington	10¢ for first 120 kw.h. per month of the total installation; all in excess 5¢ per kw.h.d. Min. charge, $1 per month per meter.
Florida	Clearwater	6¢.
	Fort Myers	Sliding scale, meter rate; 15¢ to 6¢ for 20 to 300 kw.h.
	Pensacola	5¢.
	Tampa	6¢, 10% discount.
Georgia	Athens	5¢. Min. bill $2.
	Atlanta	4¢. Min. bill $1.11 per mo. less 10%.
	Augusta	6¢ to 1½¢ per kw.h. for 200 kw.h. to 5000. With minimum charge of 50¢ to $1 per h.p.
	Columbus	11.1¢ to 5.55¢ per kw.h. for 50 to 5000 kh.p. Min. bill per month $1.11 gross. 10% discount if paid before 10th of month.
	Gainesville	10¢ base rate. Discount 10 to 25%; latter on consumption of 70 kw. or more.
	Valdosta	3¢.
Idaho	Boisé	3½ for first 50 kw.h.; 3¢ for excess 10%, discount for prompt payment.
	American Falls	2½¢.
	Potlatch	10¢. Min. $1.
	Rupert	5¢. No heater shall be installed for a period of less than 4 months continuously.
	Twin Falls	2¢ to 1¢ with monthly guarantee of $1.50 to $3.50.
Illinois	Aledo	15¢. $10 to $30 discount 30% to 50%.
	Alton	10¢ for first 300; 6¢ next 500, balance at 4¢ per kw.h. Discount 5%.
	Belleville	6¢ to 2.1¢ for 100 to 1000 kw.h. and over, less 5% discount in 10 days.
	Bloomington	5¢, discount 10%.
	Brimfield	10¢, net. Min. bill, $1.
	Canton	10¢. Discount 10% under 30 kw.h.; 15% 30 to 60 kw.h. and 20% 60 kw.h. or over.

STATE.	TOWN.	CHARGE PER UNIT FOR HEATING AND COOKING.
ILLINOIS	Cuba............	5¢, net.
(*Continued*)	Decatur.........	12¢ with 2¢ per kw.h. discount.
	Effingham.......	4¢.
	Elmwood........	10¢, net. Min. bill, $1.
	Fairview.........	5¢.
	Farmington......	5¢.
	Galena..........	7¢. Min. rate, $1.50.
	Granville........	20¢ to 9¢.
	Litchfield........	15¢ less 10%.
	London Mills.....	5¢.
	Maquon.........	10¢ net. Min. bill, $1.
	Middle Grove....	5¢.
	Momence........	4¢.
	Mount Vernon...	17½¢ to 15¢ for 20 to 150 kw.h. and over. 10% discount if paid by 10th of month.
	Paxton..........	12¢, net.
	Petersburg.......	5¢ to 4¢.
	Princeville.......	10¢, net. Min. bill, $1.
	Quincy..........	13½¢ open rate: 12¢ per kw.h. contract rate.
	Rockford........	5¢, net. Min. bill, $1 per month.
	Yates City......	10¢, net. Min. monthly bill, $1.
INDIANA........	Clinton..........	10¢ per thousand for 41,000 w.h. or less; down to 6¢ per thousand w.h. for 801,000 watt hours Min. charge 50¢; no charge when residences are unoccupied for a period of 30 days or more.
	Crawfordsville....	4¢ per kw. for 100 kw. down to 1¼¢ for 10,000 kw. 10% discount if paid before 10th of month.
	Fort Wayne......	5¢.
	Kokoma.........	4¢ for less than 5 kw. connected load; 3¢ per kw.h. for 5 kw. connected and over. Min. $1 per month.
	Madison.........	10¢ for first 50 kw.h.; 8¢ per kw.h. for second 50 kw.h., and 6¢ per kw.h. for balance.
	Noblesville.......	10¢ first 25 kw.; 8¢ per kw. for next 25 kw., and 6¢ for all over. Discount 10% 10 days. Min. 50¢.

STATE.	TOWN.	CHARGE PER UNIT FOR HEATING AND COOKING.
INDIANA (*Continued*)	Plymouth	4¢.
	Rochester	10¢ first 10 kw.h.; balance at 2½¢.
	South Bend	4¢.
	Terre Haute	8¢ 30 hrs. Max. demand; 4¢ all over. 10% discount on gross bill.
	Zionsville	12½¢ first 25 kw.h. per month; 10¢ on all additional.
IOWA	Adel	14¢ per kw.h. first 30 kw. and 7¢ for all above.
	Britt	15¢. No discount on bills of less than $2.50 per mo. $2.50 up to $3 5% discount and an additional. 1% on each 50¢ increase up to and including 15% which carries max. discount of 30%.
	Carroll	5¢.
	Charles City	10¢ for first 30 kw.; 6¢ next 30 kw., and 4¢ for all over.
	Cresco	3¢.
	Council Bluffs	6¢ less 5%.
	Dubuque	14¢ per month; balance at 6¢.
	Eagle Grove	13¢ per month up to 10 kw.; 12¢ per kw. 10 to 20; 11¢ per kw. for 20 and over. 10% discount prompt payment.
	Fairfield	14¢ per kw. up to 50 kw.; 12½¢ per kw. 50 to 100 kw.; 10¢ 100 to 150 kw.; 6¢ all over.
	Greene	15¢ per 1000 watts, meter.
	Grundy Center	10¢ for first 30 kw.h.; 7½¢ per kw.h. balance.
	Hampton	5¢ per kw.
	Jefferson	40¢ per month service charge, plus 8¢ per kw.h.
	Keokuk	10¢ for first 25 kw.h.; 9¢ next 150 kw.h.; 8¢ over kw.h. next 225 kw.h.; 6¢ next 400 kw.h.; 4¢ next 800 kw.h., and 2¢ all excess.
	Knoxville	10¢ per kw., min. 75¢.
	Le Mars	15¢ per kw.
	Mount Vernon	12½¢ per kw. per mo. up to 10 kw.; down to 9½¢ for 50 kw.; 8¢ for all in excess.

State.	Town.	Charge per Unit for Heating and Cooking.
Iowa (*Continued*)	Nevada	15¢ per kw. per calendar month for 8 kw. per cal. month, with 20% discount on all over.
	Northwood	7¢ per kw.
	Sac City	4¢. Min $1.
	Sheffield	10¢ per kw. for first 20 per mo.; 8¢ per kw. for next 20, and 6¢ for all over. Meter rent 25¢ per mo.; min. of $1 per month.
	Sioux City	12¢ base rate, with discounts from 5% to 50% on bills from $1 to $100 and over.
	Sumner	18¢ up to 14 kw.; 15¢ per kw. up to 37½ kw.; 12½¢ per kw. up to 60; 10¢ 60 to 100 kw.
	Toledo	5¢ per kw.; $2.50 minimum monthly.
	Traer	15¢ first 30 kw.h. per month; 10¢ per kw.h. next 30 kw.h., and 7½¢ for all in excess. Minimum bill, $1 per month; meter rent 25¢ per mo.
Kansas	Abilene	5¢.
	Emporia	5¢.
	Eureka	6¢.
	Great Bend	10¢ first 90 hrs.; 6¢ next 120 hrs. and 3¢ all in excess of 210 hrs., maximum demand 50% connected load.
	Hoisington	15¢.
	Junction City	4¢ per kw.
	Hutchinson	4¢.
	Liberal	15¢ per kw. for first 25 kw. per month, 10¢ next and 8¢ for all in excess.
	Wichita	12½¢. 20% disc. for prompt payment.
	Wilson	None.
Kentucky	Lebanon	12½ per kw., meter rate. Discounts of 10% to 30% 31 to 151 kw. per month.
	Lexington	15¢ less 10%.
	Maysville	10¢ straight.
	Paducah	10¢, 10% discount five days.
Louisiana	Lake Charles	15¢, 5% to 30% on bills from $5 to $120 and over.

State.	Town.	Charge per Unit for Heating and Cooking.
Maine	Brewer	3¢ net. Min. monthly charge, $2.
	Fort Fairfield	5¢. Discount 10% if paid before 10th of month.
	Oldtown	3¢ net. Min. monthly charge, $2.00.
	Presque Isle	10¢ up to 50 kw.h. to 5¢ for 500 kw.h.; 10% discount if paid before 10th of month.
Maryland	Baltimore	10¢.
Massachusetts	Abington	10¢, discount according to quantity used.
	Attleboro	5¢.
	Beverly	13¢, discount 2¢ per kw.h. paid before 10th of month.
	Cambridge	5.5–9¢ per kw.h. for first 660 to 2½¢ per kw.h. for 1280 kw.h. and over. Discount 10% if paid before 10th of month.
	Boston	12¢, with min. charge $12 per year per meter down to 6¢ for all in excess of 103 hours use of the demand each month.
	Brockton	5¼¢ net.
	Clinton	16¢ net for first 50 kw.h.; 12¢ net per kw.h. for next 250, min. charge $12 per year.
	Cohasset	10¢. Discount according to quantity used.
	Fall River	12¢ for first 100 kw.h.; down to 5¢ per kw.h. for over 3200 kw.h. Min. charge, $1 per month, discount of 10% prompt payment.
	Franklin	6¢.
	Great Barrington	18¢ less 20% if paid before 15th of month. 5¢ net to large users.
	Hanover	10¢. Discount according to quantity used.
	Haverhill	12¢, 1% discount if paid within 15 days of bill; min. charge, $12 per year.
	Lowell	6¢, 10% cash in 10 days. Min. $12 net per meter per year.
	Marlborough	5¢.

State.	Town.	Charge per Unit for Heating and Cooking.
Massachusetts. (*Continued*)	New Bedford	5¢ to 2¢ per kw.h. for from 3 h.p. to 100 h.p. Min. charge, $1.50 per month. Discount 5% if paid before 10th of month.
	North Adams	12½¢ for first 15 kw.h., 8¢ for all excess.
	Palmer	4¢.
	Pittsfield	4¢. Min. charge, $1.
	Plymouth	16¢ to 11¢ per kw.h. for 100 to 300 kw.h.; all additional 10¢.
	Salem	11¢. Min. month. charge, 50¢ each meter installed.
	Springfield	6¢ kw. net.
	Stockbridge	10¢ to 5¢ per kw. for 50 kw. to 200 kw. and over.
	Worcester	6¢ per kw.h. Min. charge, $2.50 per month.
Michigan	Houghton	7¢ sliding scale, maximum, off-peak power. Min. $1 or 50¢ h.p.
	Hudson	12¢ to 10¢ for 20 up to 40 kw. Min. charge 50¢ month discount. 2¢ per kw. if paid before 15th of mo.
	Ishpeming	12¢ to 9¢ per 50,000 watts to 150,000 watts and over. Discount 1¢ per 1000 if paid before 10th of month.
	Marine City	12¢ for first 30 kw.h. demand per mo.; 6¢ per kw.h. for all in excess.
	Port Huron	5¢ per kw.
	Saginaw	11¢ for first 30 kw.h. use of connected load per month; and 5¢ per kw.h. for all excess. Discount 25% to 40% on bills from $25 to $100 and over.
	Port Huron	2½¢. Min. charge $1 per month.
	Tecumseh	5¢ to 2¢, step price.
	Traverse City	8¢, 6¢ and 4¢ connected load rate, 30 hours' use.
Minnesota	Crookstown	$3 per kw.h. readiness to serve. 5¢ for current 15¢ straight meter rate.
	Deerwood	5¢ first 200 kw.h.; all over, 4¢ per kw.h. Min. of $1 per connected h.p. per month.

STATE.	TOWN.	CHARGE PER UNIT FOR HEATING AND COOKING.
MINNESOTA..... (*Continued*)	Duluth..........	3¢. Less 20% discount. Min. charge $1 per month.
	Eveleth..........	7–7¢ per kw. to 5–5¢ per kw. for 50 to 100 kw. and over. Disc. 10%.
	MINNEAPOLIS....	8¢ to 4½¢ per kw.h. from 100 to 600 kw.h. and over. Min. mo. bill, $1. Disc. 5% prompt pay't.
	St. Cloud........	11¢ to 5½¢ per kw. month, from 100 to 500 kw. and over. Discount 1¢ per kw. if paid by 10th. Min. charge, $1 per month.
	St. Paul.........	none.
	Winona..........	11¢ to 4½¢ per kw. for 50 kw. to 2000 kw. and over; discount 1¢ per kw. if paid before 10th of month.
MISSISSIPPI.....	Meridian........	12¢ less 10%.
	Perryville........	10¢, no discount.
MISSOURI......	Aurora..........	12¢ per kw. up to 75 kw., 8¢ for all in excess.
	Excelsior Springs.	6¢ to 3¢.
	Kansas City.....	5¢, 10% discount.
	King City.......	3¢ after a certain amount of current, in conjunction with lighting, has been used. Min. bill, 50¢ per month. Customer owns meter.
	LOUISIANA.......	10¢.
	Marshall.........	Special.
	Mayville.........	10¢ to 4¢ per kw.h. from 50 to 500 kw.h. and over.
	Norbourne.......	15¢ to 7¢ per kw. from 10kw. to 250 kw. and over.
	St. Joseph.......	5¢.
	St. Louis........	9½¢ net. Monthly min., 50¢.
MONTANA......	Anaconda........	13½. 12½% discount if paid before 15th of month.
	Butte...........	7¢ less 10% on small appliances; 5¢ net on ranges and water heaters.
	Glendive.........	20¢. 20% discount for prompt payment. Min., $1.25.
	Great Falls......	5¢ per kw. for heaters and irons; 3¢ per kw. for cooking.
	Hamilton........	4½¢ net.
	Kalispell.........	3½¢. 10% 10 days.

State.	Town.	Charge per Unit for Heating and Cooking.
Nebraska	Auburn	6¢ per kw.
	Crawford	15¢ for first 200 kw.h. per month; 10¢ for each additional kw.h.
	David City	20¢ to 12¢ per kw. from 10 to 26 kw. and over. Min. rate $1 per mo.
	Grand Island	3¢ net.
	Havelock	15¢ per kw. 1¢ discount for all current consumed above 50 kw. until 9¢ per kw. is reached.
	Lincoln	13¢ to 6¢ for 20 kw.h. to 40 kw.h. and over. 10% if bills paid before 10th.
	Omaha	6¢. Discount 5%.
	Superior	5¢ plus 30 hours demand at 15¢.
Nevada	Goldfield	5¢ on all cooking and heating meters.
	Reno	7¢ to 4½¢ for 150 to 550 kw.h. and over. Monthly minimum charge, $1.
New Hampshire	Concord	$1.20 per month per h.p. No discount.
	Derry	8½¢ with fixed service charge of $1. per month. Discount 5% payment by 10th of month.
	Dover	8¢ plus $1 service charge. Discount 5% if paid before 10th of month.
	Manchester	12¢. Discount 5% payment before 6th of month.
	Newport	10¢, 25¢ per month service charge.
	Portsmouth	5¢ net.
New Jersey	Summit	5¢ with service charge of 75¢ per mo.
New Mexico	Albuquerque	5¢ per kw. $1.50 minimum.
	Deming	8¢ to 3¢ per kw. for 100 up to 500 kw. and over, with service charge per h.p. $1.
New York	Albany	None.
	Amsterdam	None.
	Babylon	10¢ per kw. 100 kw. per month; 5¢ for all in excess.
	Binghamton	2¢ when used with house lighting.
	Mount Kisco	15¢, 13¢ and 10¢. Min. charge $1 per month.
	Broadalbin	Special price; regular rates 10¢ per kw.h.
	Buffalo	9¢ to 4¢.
	Clinton	11¢ base rate; discount 10 to 50%, for 75 to 3750 kw.h.

State.	Town.	Charge per Unit for Heating and Cooking.
New York..... (*Continued*)	Cooperstown.....	Same.
	Corinth..........	8¢ to 6¢ for 50 to 150 kw.h. per month and over.
	Far Rockaway....	6¢.
	Fulton..........	6¢, discount 1¢ per kw.h. if paid in 15 days. Min. charge, 75¢ per mo.
	Gloversville......	9¢. Min. charge, 50¢ per month.
	Hudson..........	12¢.
	Jamestown.......	5¢, less 10% for prompt payment.
	Kingston........	15¢ for first 60 hrs. of demand per mo.; all excess 5¢. Discount of 2% to 20% on bills from $10 to $100 and over.
	Liberty..........	15¢ to 10¢ per mo.; for 100 to 400 kw.
	Lockport........	10¢ to 6¢ for 50 to 400 kw. and over. Discount of 25% if paid on or before the 10th.
	Palmyra.........	4¢ net.
	Newark.........	4¢ net.
	Lyons...........	4¢ net.
	Clyde...........	4¢ net.
	Norwich.........	10¢ to 4¢ for 100 kw. to 2000 kw.
	Nyack...........	$6 per month from April 1st to Oct. 1st. 4¢ per kw. Oct. 1st to April 1st.
	Phelps...........	4¢.
	Port Jervis.......	14¢ to 10¢ for 10 to 40 kw.h.
	Poughkeepsie.....	5¢ average net.
	Rhinebeck.......	20¢ to 10¢ per kw. for 10 to 200 and over. Discount 5% if bills are paid in 10 days.
	Rochester........	6¢ per kw.
	Rome...........	15¢ per month to 8¢ for 40 to 1300 kw.h. and over. Discount of 10% on all bills paid before the 10th of month.
	Schenectady.....	5¢ flat rate, min. rate $1 per month.
	St. Johnsville.....	8¢ net.
	Utica...........	11¢ to 4¢ per kw.h. for 60 to 1170 kw.h. and all in excess. Min. rate $1 per month.
	Walden..........	12¢ to 9¢, from 100 to 200 kw.h. and over. Min. charge $1 per mo. Disc. 10% paid before 10th of mo.

State.	Town.	Charge per Unit for Heating and Cooking.
New York..... (*Continued*)	Yonkers.........	12¢ to 6¢ for 60 to 360 kw.h. and over. Min. monthly charge $3.
No. Carolina..	Asheville........	15¢ first hours of one-third total installation; 7½¢ for balance.
	Raleigh..........	5¢ flat.
	Salisbury........	12¢ to 6¢.
	Spencer..........	12¢ to 6¢.
No. Dakota....	Devil's Lake.....	11¢ per kw. net.
	Mandan..........	4¢ per kw. Min. $1.
	Minot...........	9¢ to 4¢ for 100 to 5000 kw.h. Disc. of 10% paid before 10th of mo.
Ohio...........	Canton..........	9¢ to 5¢ for from 2 to 5 hrs. daily use.
	Columbus........	15¢ per season per sq.ft. of radiating surface.
	Coshocton.......	15¢ per season per sq.ft. of radiating surface.
	Defiance.........	8¢ to 5¢ net for 100 to 600 kw.h. and over. Min. bill, 75¢.
	Kent............	10¢. Disc. of 10% on bills over $10.
	Massilon.........	$15 per year (payable monthly) plus 3¢ per kw.h. for all current used. Discount 10% in 10 days.
	Middletown......	10¢ to 7¢ for 150 to 601 kw.h. and over. Disc. 10% paid before 10th of mo.
	New Philadelphia	Multiple rates, 15 and 03, and 10 and 05, based on 30 hrs. use per mo. of demand, first 30 hrs. at high rate, all excess at low rate.
	Wauseon........	12½¢ per kw. for 12 kw. excess at 5¢.
	Lima	
	Zanesville........	8½¢ for 25 to 2400 kw.h. and over. Discount 5% if bills are paid before 10th. Min. 50¢.
Oklahoma.....	Bartlesville......	10¢ to 5¢ per kw. for 30 to 1000 kw. and over. Min. charge, 50¢. Discount 5% paid before 5th.
	El Reno.........	12¢ to 5¢ for 100 to 5000 kw.h. Min. charge $1. Discount 5% for prompt payment.
	Holdenville......	5¢.
	Oklahoma.......	5½¢ to 2½¢ for 500 to 5000 kw.h. Min. charge $1. Discount 10% if paid before 10th of mo.

STATE.	TOWN.	CHARGE PER UNIT FOR HEATING AND COOKING.
OKLAHOMA...... (*Continued*)	Sapulpa.........	5¢ to 2¼¢ for 500 to 5500 kw.h. Disc. 10% if paid before 10th of mo.
	Shawnee.........	5¢ per kw.
OREGON........	Dallas...........	5½¢ less 10% disc, paid by 10 of mo.
	Hood River......	5¢, $1 minimum, or flat rate of $2.50 per month for special stores.
	Independence....	5½¢, less 10% discount bills paid on or before 10th of mo.
	Klamath Falls....	$8 per month (combined rate for cooking and heating); or flat rate of 15¢ per 100 watts rated capacity per mo.
	Medford.........	Same.
	Monmouth.......	5½ less 10% discount bills paid on or before 10th of month.
	Portland.........	4¢. Min. charge $1 per month.
PENNSYLVANIA..	Allentown.......	8¢ to 2.1¢ per kw. for 25 to 3000 kw. and over 10% discount bills paid before 15th of month.
	Canton..........	16¢ to 10¢ 20 M. to 200 M. and over. Watt hours.
	Ebensburg.......	4¢ per 1000 watts (meter).
	Erie.............	10¢. 5% discount.
	Hanover.........	5¢ flat rate.
	Lemoyne........	4¢.
	Maine Line Dist..	12¢ and 10¢.
	Mauch Chunk....	6¢ per kw.
	Millersburg......	10¢. Discount 5% to 20% on bills from $3 to $20.
	Philadelphia.....	10¢ meter rate and 12¢ meter rate.
	Pottsville........	6¢ with 16⅔% disc. $1 min.
	Punxsutawney....	5¢ or 15¢ on 50% demand, 3¢ for all over the demand.
	Reading.........	6¢ per kw., 5% discount for cash.
	Athens..........	2¼¢, monthly demand charge.
	Sayre...........	2¼¢ monthly demand charge.
	S. Waverley......	2¼¢ monthly demand charge.
	Waverley, N. Y...	2¼¢ monthly demand charge.
	Vandergrift......	6¢ per kw., all metered, subject to disc.
	Warren..........	4¢ less 10%.
	Waynesboro......	15¢ to 2¢ per service unit from 1 to 15. (Service unit is 5 hrs. use of the max. demand in kw. plus 6 kw.h.)

State.	Town.	Charge per Unit for Heating and Cooking.
Pennsylvania.. (*Continued*)	Wilkes-Barre.....	10¢ to 4½¢.
	Williamsport.....	$19.20 per kw. per year, fixed charge, plus 1.1¢ per kw. less 6¼% disc.
Rhode Island..	Newport.........	12½¢ to 3¢ per kw. monthly for 200 to 2700 kw. and over. Min. charge, $1.25. Disc. 20% 10th.
	Pawtucket.......	10¢ net.
	Wakefield........	15¢ net.
	Peace Dale.......	15¢ net.
	Narragansett Pier.	15¢ net.
	Woonsocket......	12½¢. Min. charge $1 per month.
S. Carolina....	Anderson........	4¢ per kw.
	Charleston.......	10¢ to 4¢ for 75 to 500 kw.h. and over. Min. 50¢ per month.
	Florence.........	15¢ to 10¢ per kw. for 10 to 50 kw. and over.
	Georgetown......	15¢ to 10¢ per kw. for 30 up to 200 kw.
	Sumter..........	3¢ per kw.
So. Dakota....	Rapid City......	5¢ and 3¢. Min. $3 per month.
	Sturgis..........	6¢.
Tennessee.....	Bristol..........	10¢ and 8¢ per kw. for 25 kw. and over.
	Johnson City.....	3¢ per kw. Min. charge $2.50.
	Memphis.........	$1.50 per kw. and 4¢ net for cooking.
	Shelbyville.......	10¢ and 5¢ for 50 kw.h. and over. 25¢ per month meter rent.
	Wartrace........	10¢ and 5¢ for 50 kw.h. and over. 25¢ per month meter rent.
	Manchester......	10¢ and 5¢ for 50 kw.h. and over. 25¢ per month meter rent.
Texas.........	Amarillo.........	15¢ per kw. Min. mo. charge, $1.50.
	Beaumont.......	5¢ net.
	Brenham........	10¢ per kw.
	College Station...	8¢ and 10¢.
	Cuero...........	15¢.
	Dallas...........	10¢ to 6¢ for 300 kw.h. to 4000 kw.h. and over. 10% discount if paid within 10 days. Min. monthly rate, $1.
	Houston Heights..	6¢.
	Marshall.........	14¢ to 8¢ per kw. for 50 to 500 kw. and over; discount 10% for prompt payment.

STATE.	TOWN.	CHARGE PER UNIT FOR HEATING AND COOKING.
TEXAS (*Continued*)	Port Arthur	20¢ to 9¢ for 10 to 300 kw.h. 10% payment in 5 days.
UTAH	Salt Lake City	6.6¢. Min. charge, $2 per month. 5% discount, payment in 5 days.
VERMONT	Manchester	12¢ per kw. to all-the-year customers; 20¢ to summer customers only.
	Montpelier	4¢. Min. charge, $1 per month.
	St. Albans	5¢ net.
	Woodstock	5¢ to 3¢ per kw. for 50 kw. and over. Min. $1.
VIRGINIA	Alexandria	5¢.
	Hampton	4½¢ net.
	Lynchburg	8¢ to 6¢ per kw. for 100 kw. to 300 kw.
	Newport News	4½¢ net.
	Roanoke	5¢. Min. charge, $1 monthly.
	Staunton	3½ to 4¢ per kw.h.
	Warrenton	5¢.
	Waynesboro	4¢ for 6 irons and over.
	Winchester	10¢ per kw, with discounts, 10% to 30% for 10 to 100 kw.
WASHINGTON	Aberdeen	5¢.
	Anacortes	15¢ to 7¢ for 30 to 60 kw. and over, 10% disc. for prompt payment.
	Bellingham	4½¢ net. Min. charge, $1.50 per h.p. per mo.
	Brewster	7¢ to 4¢ for 10 to 30 kw.h. and over.
	Bridgeport	7¢ to 4¢ for 10 to 30 kw.h. and over.
	Pateros	7¢ to 4¢ for 10 to 30 kw.h. and over.
	Colville	12¢ to 5¢. Monthly min. charge, $1.
	Seattle	3¢. Monthly min. charge, $1.
	Spokane	5¢. Min. bill, $1 per month.
WEST VIRGINIA	Bluefield	3¢, with primary charge of $1 per mo. per kw. of maximum demand.
	Parkersburg	7½¢ per kw. Min. charge, $1 per mo.
WISCONSIN	Ashland	2¢.
	De Pere	6¢ per kw. net.
	Eau Claire	3¢ per kw.
	Janesville	10¢ per 1000 watt hours; discount 5% to 30% on bills from $5 to $50 per month and over. 5% discount additional if bill is paid before 5th of month.
	Lake Geneva	15¢ straight.

STATE.	TOWN.	CHARGE PER UNIT FOR HEATING AND COOKING.
WISCONSIN . . . . . (*Continued*)	Mellen.	10¢ to 4¢ per kw. for 50 to 150 kw. and over.
	Monroe.	6¢.
	Park Falls.	12¢ per kw. Min. charge $1. 5% cash in 10 days.
	Portage.	5¢ per kw. Service charge, $1 per kw.
	Sheboygan.	6¢ for first 1500 kw.h., plus a fixed charge of 10¢ per month.
	Sparta.	6¢.
	Tomah.	15¢ per 1000 watts, with discount.
WYOMING.	Casper.	6¢ to 4¢ per kw. for 100 to 200 kw. and over.
	Evanston.	20¢.
	Laramie.	7¢ with 10% disc. for 24 hrs. use.
	Rawlins.	4½¢.
	Sheridan.	4¢.

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ELECTRICITY as a cooking and heating agent has firmly established itself. Its handiness and cleanliness, its quick, ever-ready service, its complete heating control, and its many other advantages have received due public appreciation and recognition.

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¶ Carron Electric Appliances are the outcome of exhaustive tests, and give a service that fully maintains the Company's reputation extending over a century-and-a-half.

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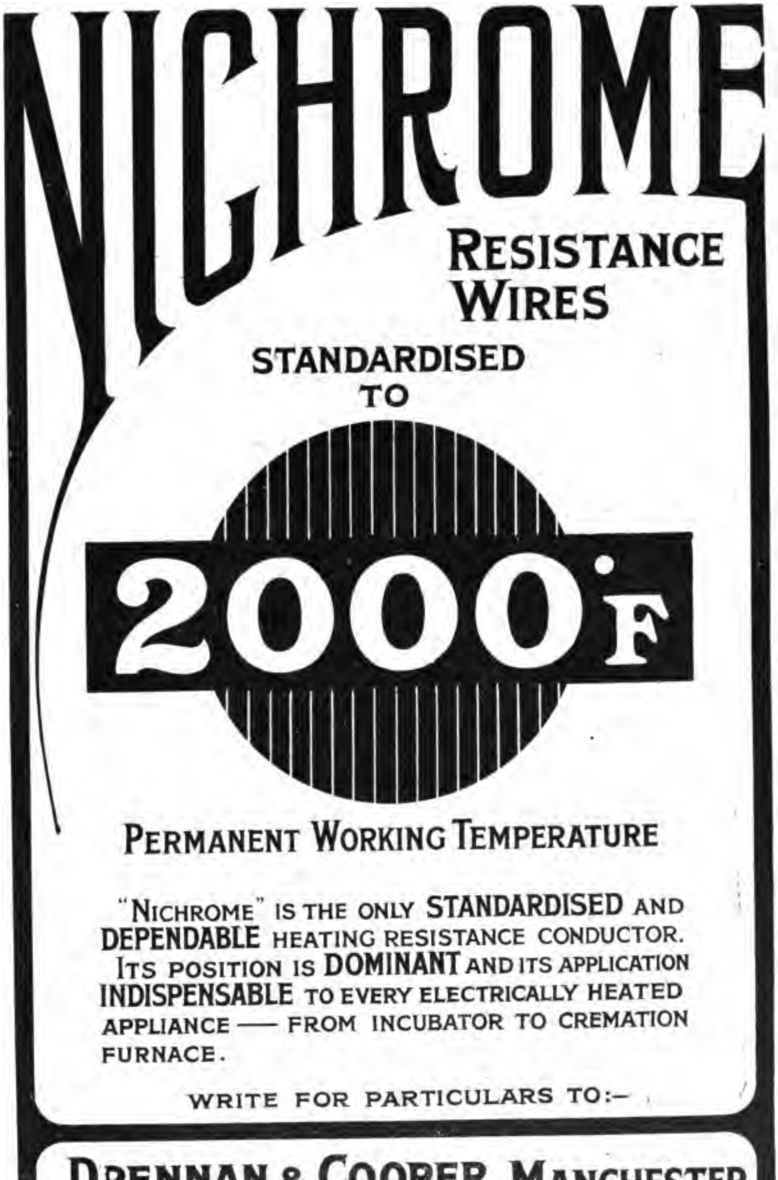
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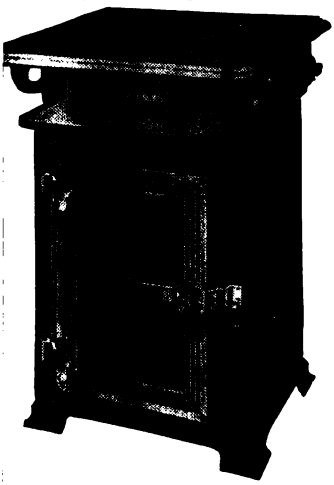

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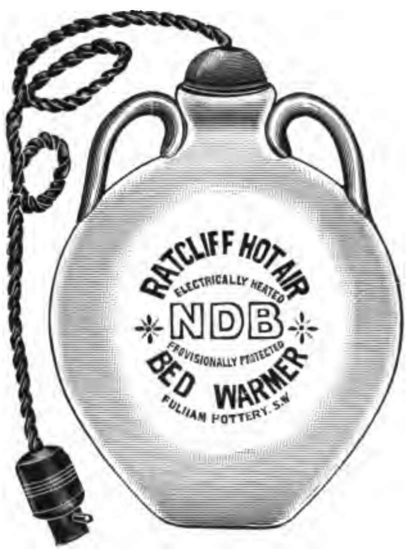

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